

# Julia Little 5 Books in One—at the Price of One!

FEW HOURS—perhaps a few minutes — from your front door, in woods, field, or tream, there is a world of busy life which seldom meets the human eye. Here are unfamiliar four-footed creatures, that swim and fly; here are species of living things whose ways of ife are so different from, and again a startlingly similar to, our own human ways.

Multiply such a patch of wild life car your home by the length and readth of America and you have one f nature's greatest and most varied of lection of living wonders on the ace of the earth. To witness the daily ves of these wild creatures has been he privilege only of the fortunate few, ossessing the time, knowledge and quipment necessary for close observaion. Now, however, this fascinating nimal world is brought to you within he covers of one wonderful, exciting olume, to be enjoyed comfortably at our leisure. Here at last is a book to pen your eyes to the marvels of Amercan Wild Life in brilliantly accurate nd profusely illustrated stories!

# 001 Extraordinary Stories with resistible Pictures—for Enjoyment of the Entire Family!

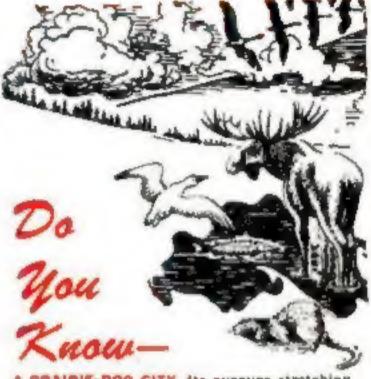
f you spent years and traveled thouands of miles with camera and gun nd traps, you could not record a fracion of the interesting photographs nd stories that are contained in American Wild Life," No one man ould accomplish the task, 160 specialqualified writers from all 48 states

gathered all available data from the records of regional natural history institutions, government specialists, state naturalist societies, zoological authorities, and every other source of recognized information. From this wealth of material, these 160 writers drew the fascinating stories for "American Wild Life." The result is a five-volume-inone library of enjoyable reading, prepared in popular narrative style, so that not only grownups but every boy and girl will derive pleasure and information from it. It will also prove of great enjoyment and usefulness to sportsmen, hunters and anglers.

## 749 Pages—327 Thrilling Pictures Including Full-Page Photos in Natural Color!

The extraordinary collection of wild life pictures in this volume vies with the text for interest. The 327 pictures show an amazing variety of wild creatures in their natural haunts, their everyday attitudes and ways of living. Here is the art of the photographer in its carest form; to it has been added the art of modern photoengraving, which renders every detail of the originals with marvelous fidelity. The crowning feature of the collection is a series of six full-page plates in NATU-RAL COLOR, which you may be tempted to remove for framing!

The giant Self-Pronouncing Index lists 1,914 different names of wild creatures! It enables you to find instantly in this book any animal subject in which you are especially interested.



A PRAIRIE-DOG CITY, its avenues stretching for many miles, constitutes nothing less than a subterranean housing development on a large scale!

to Rio itself of fifes, the los, taking a slick in its mouth, slowly submerges in a pool of water. As it sinks, the fless move upward to drier regions. When only the wood remains above the surface, the fless desert the sinking for to take refuge on the raft. Thereupon the fex releases the etick, leaving the fless to their late.

THE CLASSIC BELIEF is that the bat becomes entangled in a woman's hair and cannot be removed until every one of the fair victim's locks is elipped to the scalp. Yet there is no record of this ever happening!

THE YOUNG OF THE OPOSSUM are so small at birth that a litter of sixteen easily fits on a tablespoon!

SHITCHHERER OF THE HIGH SEAS is the sharksucker, a fish that attaches itself to the body of a larger fish or sea turtle and rides unmolested on the abdomen of its powerful companion.

phenomena described in this thrilling book.

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—R. H. B., Safety Harbor, Flo.

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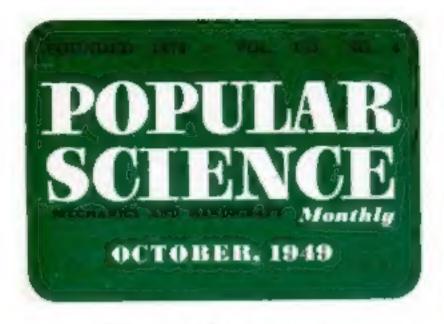
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# BETTERIN' the VETERAN

—a story about

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# INIEKEENLI FFF SION

in many areas, a car with the motor running can ruin a television program. Ordinary sport plugs broadcast a signal which interferes with television reception. A switch to Auto-Life Resisfor Spark Plugs will check this annoyance.



Checked by

here!

# British Bill Would Curb Spark Plug Interference With Television

London-The Government announced tonight that it is enacting legislation making persons subject to \$400 fine and possible juil sentence of three months for causing interference during peak radio and television periods. For example, motorists will be asked to fit suppressors to their motors.

# HERE'S THE PROBLEM

Few people realize that a major cause of faulty. television reception, particularly in areas where the television signal is weak, originates not in the set itself but from ordinary spark plugs in nearby automobiles. This poor reception, jumping and wobbling in the image, comes from the radiation of the electrical discharge in passing vehicles-your car, your neighbor's, or delivery cars or traffic on your street. The ordinary automobile spark plug acts as a miniature broadcasting station that frequently spoils what would otherwise be clear, sharp television images.

# Read What Television Experts Say:

FRANK STANTON, Procisions, Columbia Broadcasting Systems
"There is no question in my mind that ignition interference is a contributory cause to poor television reception. The resistor type spork plug appears to be the porwer.



J. R. POPPELE, Provident, Television Proedcusters Association of America: "Interference by automobile ignition systems to television is quite common and is often very severe in outlying great, I have withoused tests in which the new Auto-Lite Resistor Spark Plug was very effective In reducing interference to talevision receivers under such conditions."

W. R. MacDONALD, President, Rodio-Television Institute: "The sooner every cor and truck in America is equipped with the new Auto-Lite Resistor Spark Plug, the better it will be for the felevision industry and every-one who owns a television set."



An authoritative esticle, "Television Brings Change in Car Ignition Behavior," reprinted from the S.A.E. JOURNAL published by the Society of Automotive Engineers, is evaluable without charge.



The effect of ardinary spark plugs on the TV image is shown in this scene from Auto-Lite's "Suspensel" show, "The Creamer" storeing bline forb and fathan 9---

# BA NKINWAKA ZAWKK HINES AUTO-LITE Resistor Spark Plugs

# HERE'S THE ANSWER

The new Auto-Lite Resistor Spark Plugs check television interference normally caused by ordinary spark plugs. Blurred, flipping and distorted images, due to this type of interference, become clear pictures like the one at right below. So install Auto-Lite Resistor Spark Plugs in your car-urge your neighbors and neighborhood delivery service to use this better plug too. This "good neighbor" policy will help everyone in your community enjoy television at its best. It's easy to do . . . switch to Auto-Lite Resistor Spark Plugs!



A SMOOTHER ENGINE IDLE The Auto-Lite Resistor Spork Plug permits wider spark gap to help offmingte occasional

IMPROVED GASOLINE ECONOMY Permits burning of leoner mixtures and reduces

INCREASED ELECTRODE LIFE

Because electrode erosion is reduced, elec-Irade life is increased up to 200% and more. \* Culaway view shows the 10,000 Ohm Resistor which permits wider initial gap sellings to make possible the extra benefits obtained from Auto-Lite Resistor Spark Plugs,

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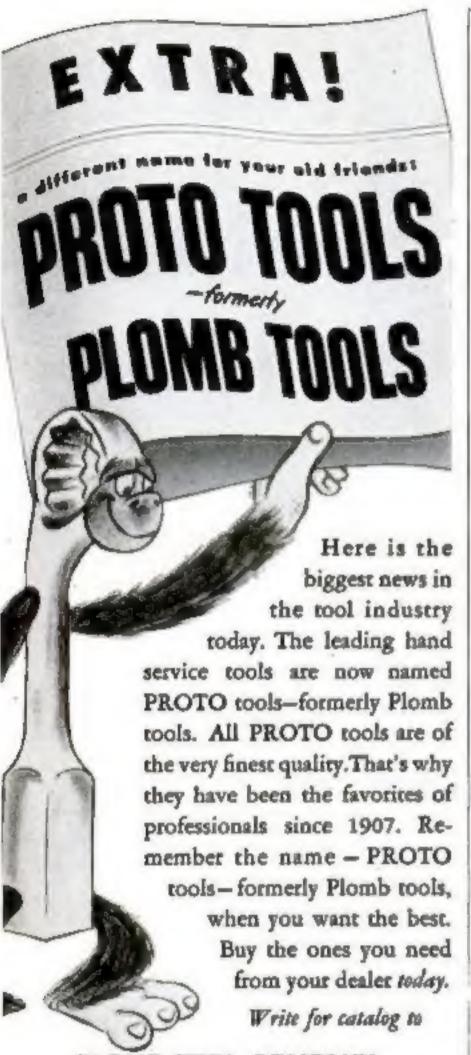


This clear image shows how better television is possible when Auto-Lite Resistor Spark Plugs check interference. The creme is the rome or that shows at the left

# Switch to Resistor

Now Standard Equipment on Man: Leading Makes of Cars and Trucks

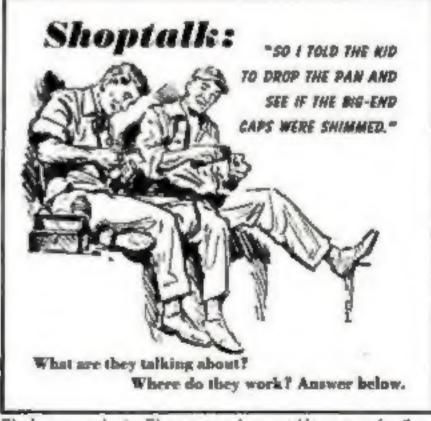
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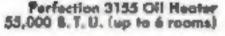
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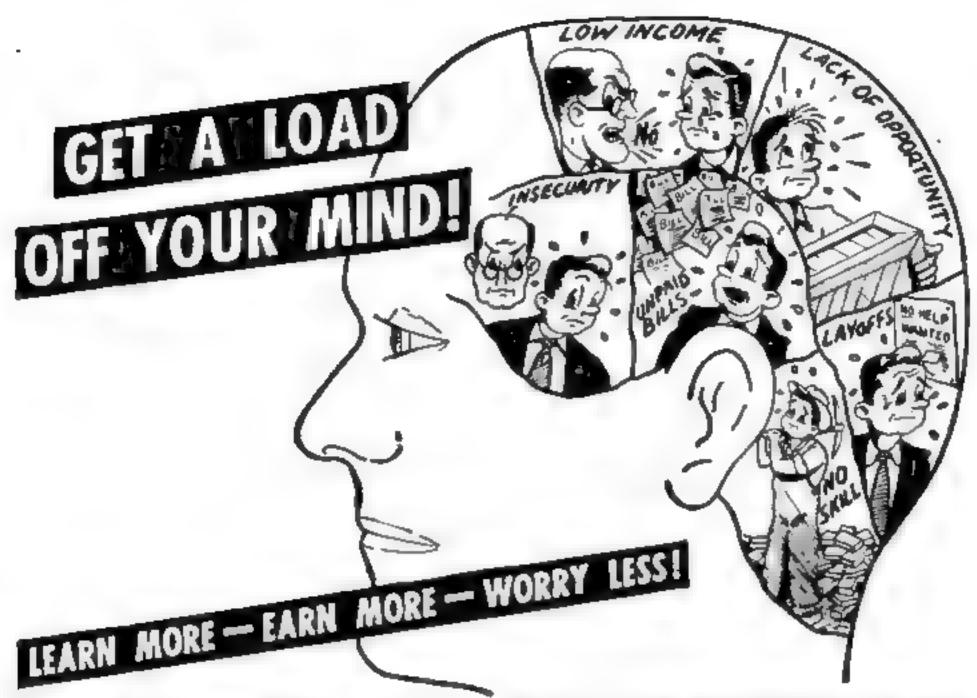
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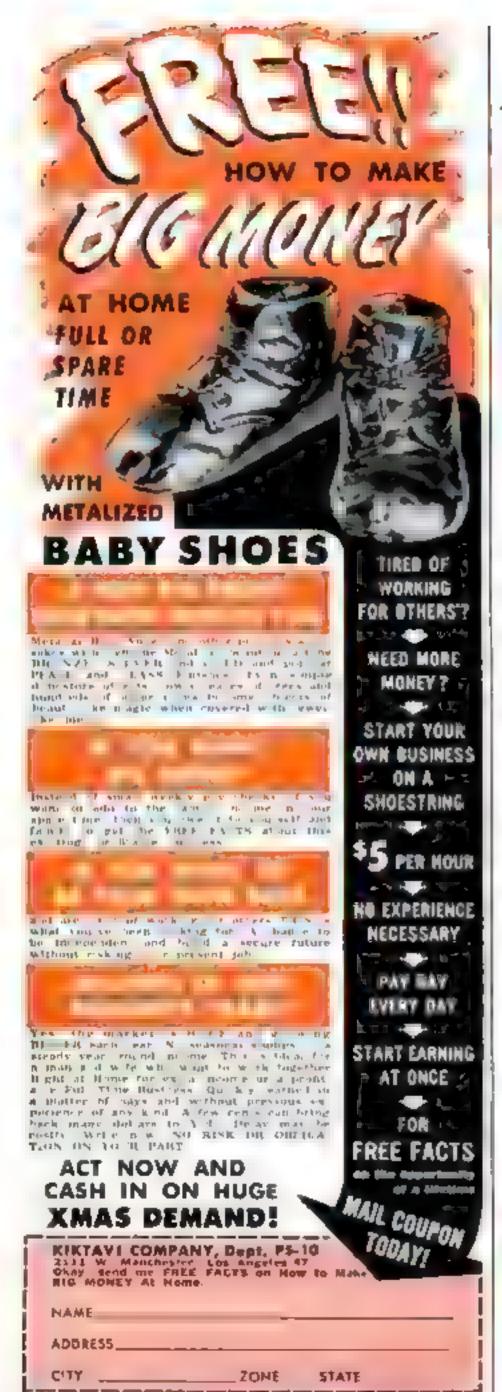
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# Letters



#### Satisfied with Old Moon

Sir:

I should think that the science world would see fit to expend its wisdom on something of more positive potential value than "building a new moon" IPS, May '49,

p. 106].

Somehow it seems that this feat, even though inviting, is an impossibility. Let us assume that the earth is a round plate so as to simplify my thesis. We now draw one radial line and extend same into and past the last assumed rarefied circle of the earth's atmosphere. I believe that in this region the gravitational force or attraction on any missile is assumed nil.

Let us now assume our rocket will travel along this radial line beyond gravity. Our rocket now intercepts no resistance. It also moves through space at a constant speed. I can't see any common sense in believing that the rocket can possess some oddity that will enable it to turn of its own volution and travel in a curve around the earth.

R. KLINGBEIL

Woodhaven, N. Y.

You make one too many assumptions. The earth's gravitational attraction does decrease as you go out into space, but it is by no means "nil" at 22,300 miles away—the farthest distance suggested for PS' orbiter. Gravity would keep the orbiter circling the earth in the same way that it keeps the real moon in its path—and that's about 240,000 miles away.

## You Can't Please Everybody

Sir:

I am getting disgusted. When I started buying POPULAR SCIENCE I enjoyed it very much. Now my interest is slowly growing dimmer. Why? Because Popular Science now has more mechanics in it than it has science. The greater part of the articles tell about the advancements in the more mechanical fields such as progress in engine design and construction, new inventions in the automotive field and even different construction ideas on building a more roomy

# "What's he got that I haven't got?"

LOOK at the successful men you know. "What have they got" that you haven't?

Very little, probably, in most ways these men are no brighter or naturally more capable than average, Many of them probably have no more formal education or better natural aptitudes than you.

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home. Such articles are all right in their place, but I don't think their correct place is Popular Science. Why don't you live up to the name of Popular Science and insert more articles which will arouse real scientific interest? I think if you would devote more pages to such fascinating subjects as chemistry, astronomy, physiology, biology, atomic energy, and medicine it would raise Popular Science magazine to a greater magazine.

ROBERT E. ZHAIK

Toledo, O.

On the other hand . . .

Sir:

I like your magazine very much, but one thing I don't like is stuff about atoms and things that take high-geared brains to read. I'm not that smart. Excuse me if I'm blunt I like things like making things for the dark-room and cameras.

CHESTER LEWIS

St. Louis, Mo.

What PS tries to do is serve up a "balanced meal" that covers the wide range of science and mechanics. No reader is expected to like everything in every issue, just as no restaurant patron is expected to like everything on the menu. But that doesn't mean you can't get enough to eat.

#### Credit Where Due

Sir:

I was particularly interested in the article "Steam Now Cools, Too," appearing in your August issue on page 136. The article states that the Carrier Company has developed a new air-conditioning system whereby waste steam is utilized to produce cooling. This certainly is not anything new—just the old "absorption system," developed years ago.

Servel, Inc. has been manufacturing an air conditioner for the past ten years that cools in the summer and heats in the winter by steam.

RAY D. FREEMAN

Louisville, Ky.

Servel says it was the first to introduce an air-conditioning system of this general type, but that it was designed "for residential and small commercial usage." Carrier's system, for large applications (theaters, department

Continued on Page 11





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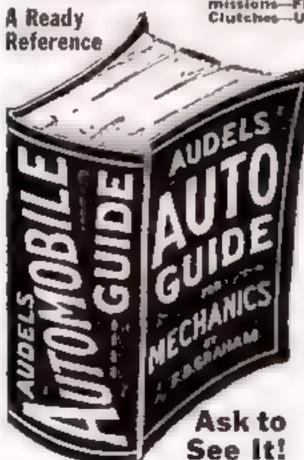
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#### "Bot Wires" Gets Warm Welcome

I found the article entitled "How Linemen Handle Hot Wires and Stay Alive" [PS, July '49, p. 144] by George H. Waltz, Jr. to be most interesting and instructive.

At the last meeting of our local I brought this article to the attention of the members and requested that they read it. It was found that some had read it, and a number of those present were deeply interested.

ROY F. CARAHER

International Brotherhood Electrical

Workers. Utica, N. Y.

### Unsung Heroes

Sir.

I would like to take this opportunity to thank the staff of PS and especially Devon-Francis for the article "How Motion Pictures Are Projected" in your August 1949 issue [p. 150].

At last a mention has been given to a very important phase of a great industry. Hardly anyone notices the projectionist in the booth at all

However, we are still there and thousands of projectionists and engineers in theaters and laboratories all over the United States, Canada, and the world are constantly working and striving to achieve even better and greater results for you.

> MICHAEL D. HALL Projectionist, "Metro" Theater

New Westminster, B. C., Canada

#### Argument for Superbombers

Sir:

I read with interest the article in the August issue "Can Superfighters Stop the Bombers?" [p. 90]. However, I think that you have a good answer to a poor question.

It seems that neither you nor many of our national figures fully realize the importance of the development of the V-2 rocket. Fortunately for us Mr. Hitler had no atomic bomb to put in the nose of his V-2. As a former lead bomber pilot in Europe I had the experience of seeing V-2s going up and hearing them come down. I believe that



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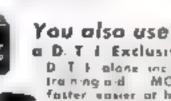
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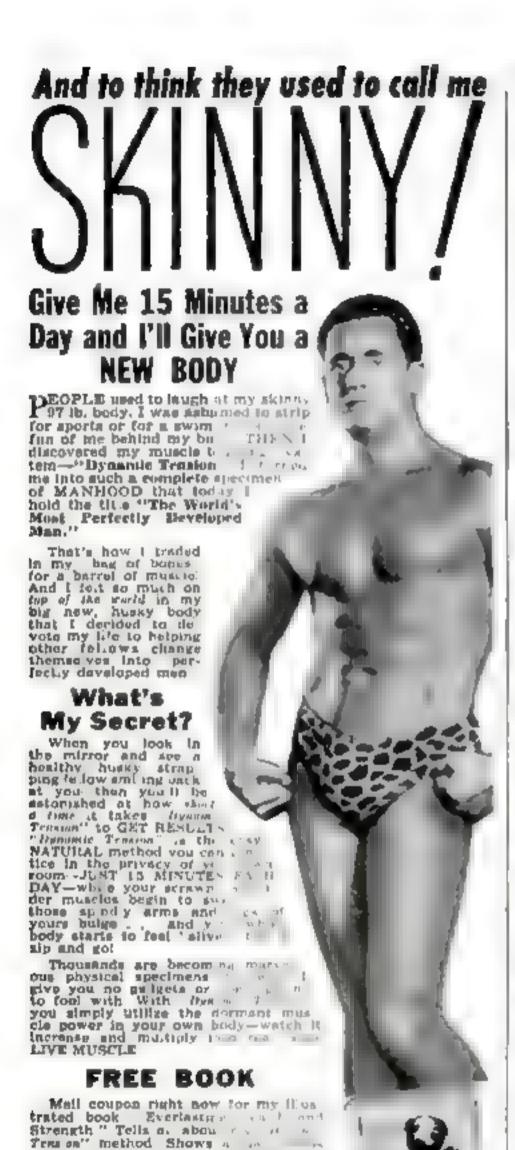


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VICTOR F. PFENDLER

Cleveland Heights, O.

# You Pays Your Money . . .

Sir:

Having been a projectionist for about 15 years, I feel your article "How Motion Pictures Are Projected" [Aug. '49, p. 150] could stand some revising. First: "The first dots warn that it is almost time to switch reels." It is no warning whatsoever, it is a clue to start the motor.

Second: "In a moment he switches on the current to start the second machine rolling." This sounds as if he just starts it at random: actually he starts it when he sees the first

clue as previously stated.

Third: "Practice tells him when his 20 feet of "leader" will have run past the film gate." He does not rely on practice; he rehes on a pair of signals. Furthermore there is not 20 feet of leader. Most operators "thread" on a figure 8, which means there are 8 feet (not 20) to run past the film gate.

Fourth: "An ingenious variable-speed motor feeds the positive carbon into the are at just the rate that the carbon is burned." What about the negative carbon? It would be hard to keep a good light on the screen if the motor feeds only the positive carbon. The fact is the motor feeds both the positive and the negative carbons, keeping the are equidistant from the film. JAMES SCHOLL

Jamestown, Ky.

PS is grateful to Reader Scholl for the additional information on motion-picture projection. Before publishing the article, we checked it for factual accuracy with the chief engineer of the largest manufacturer of commercial projection machines.

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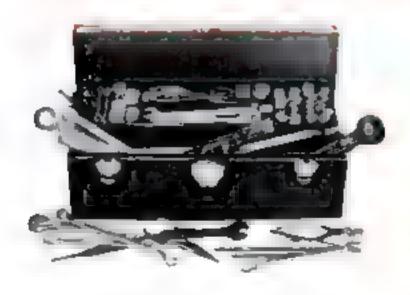
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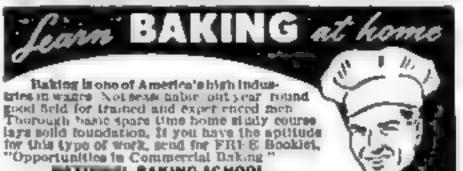
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TRY IT SOME TIME. Concentrate intently upon another person seated in a room with you, without his noticing it. Observe him gradually become restless and finally turn and look in your direction. Simple—yet it is a positive demonstration that thought generates a mental energy which can be projected from your mind to the consciousness of another. Do you realize how much of your success and happiness in life depend upon your influencing others? Is it not important to you to have others understand your point of view - to be receptive to your proposals?

How many times have you wished there were some way you could impress another favocably --- get across to him or her your ideas? That thoughts can be transmitted, received, and understood by others is now

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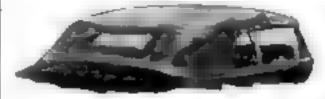
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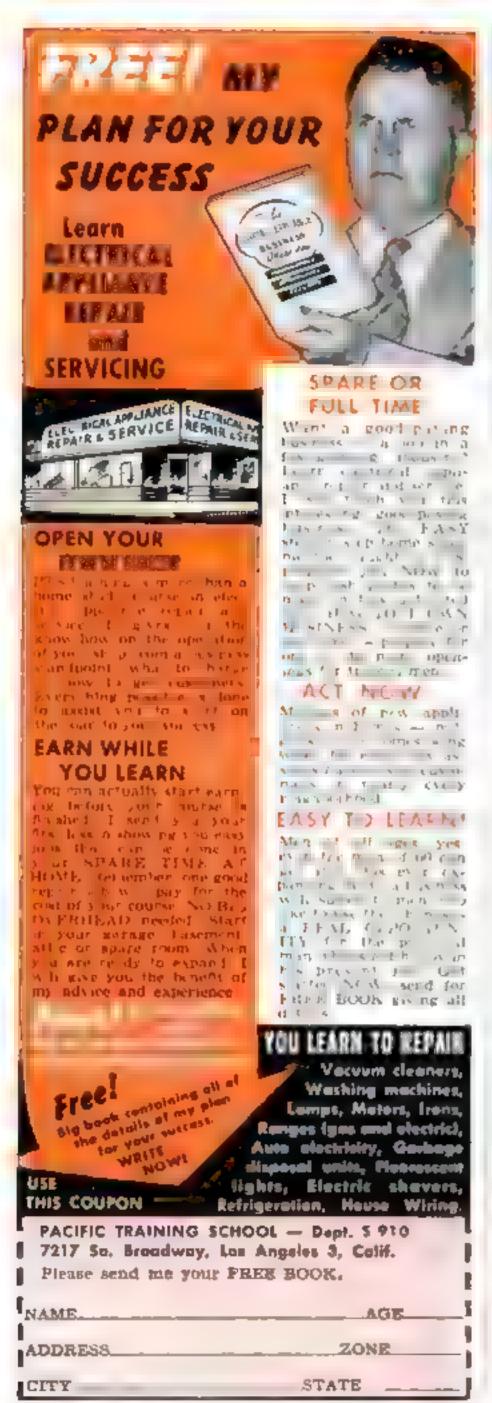
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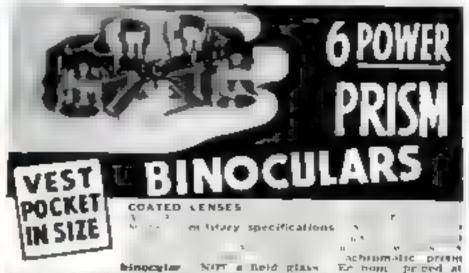
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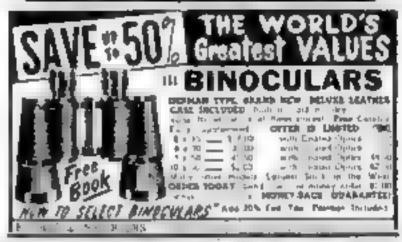
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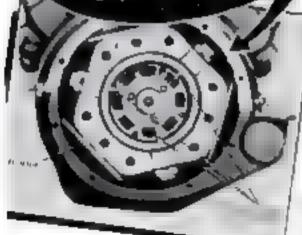
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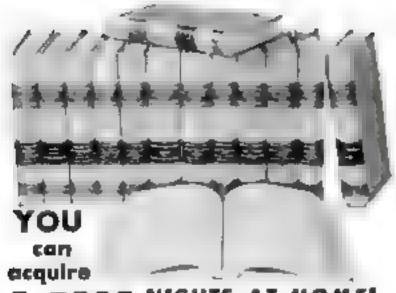
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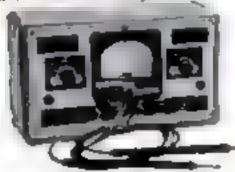
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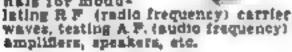


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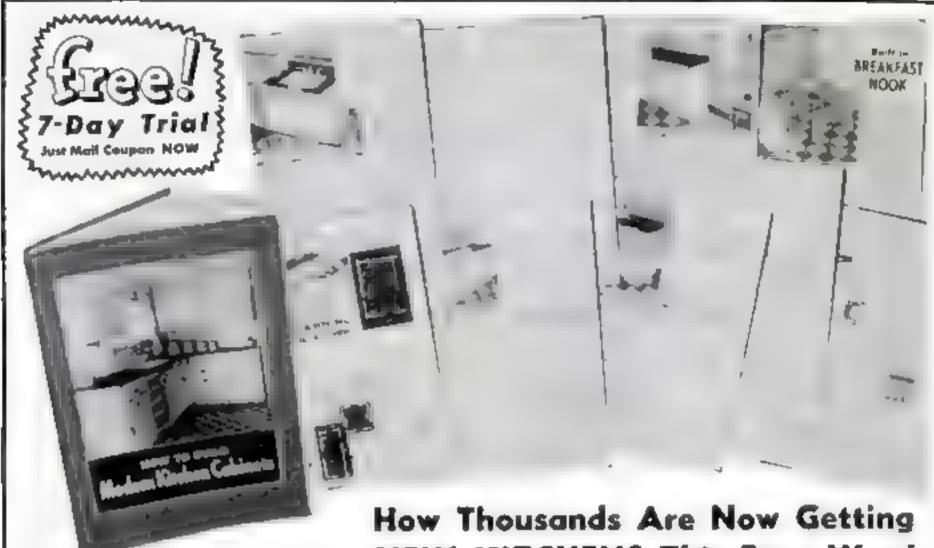
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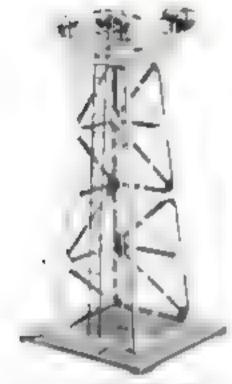
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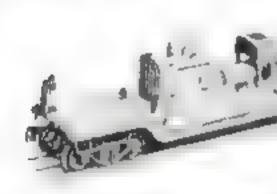


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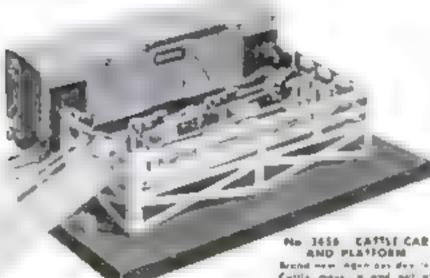
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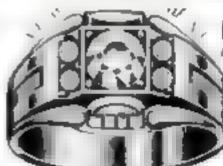
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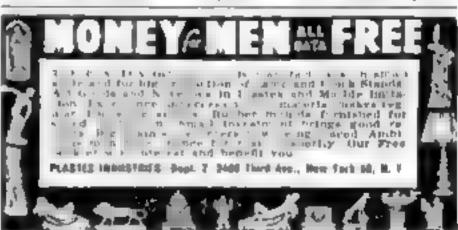
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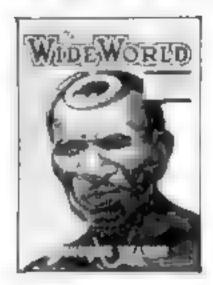
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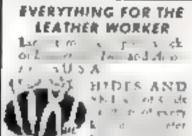


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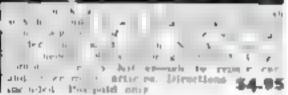
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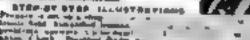
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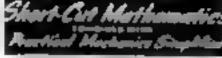
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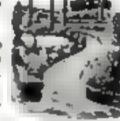
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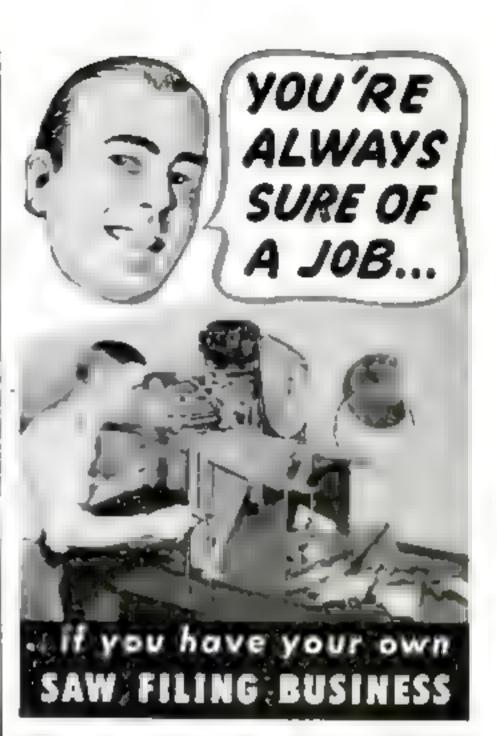
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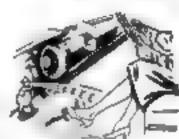
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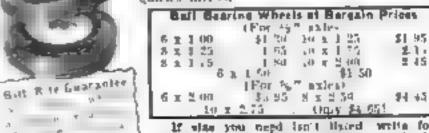




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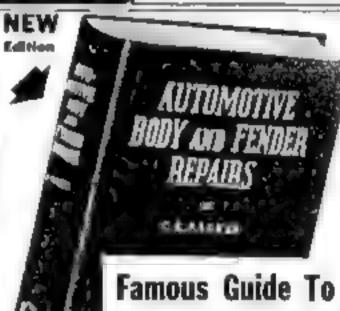
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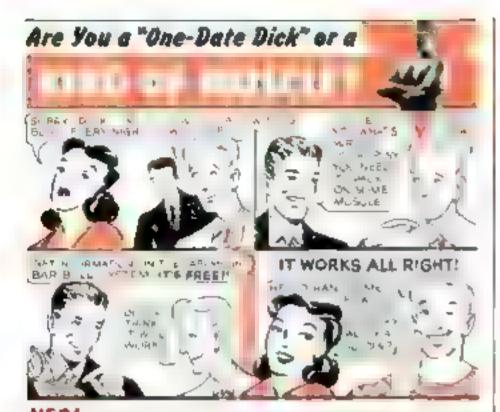
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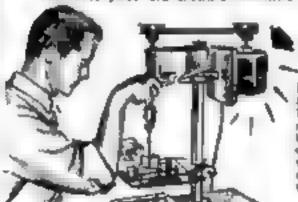
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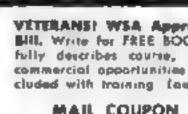
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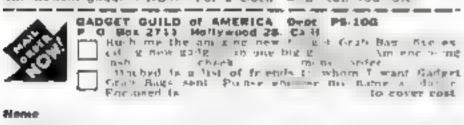


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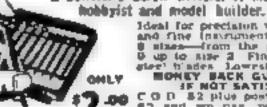
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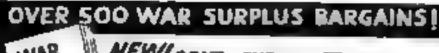
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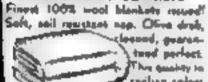
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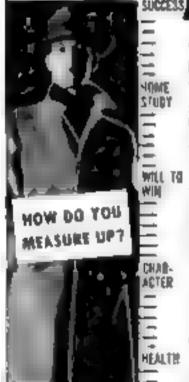


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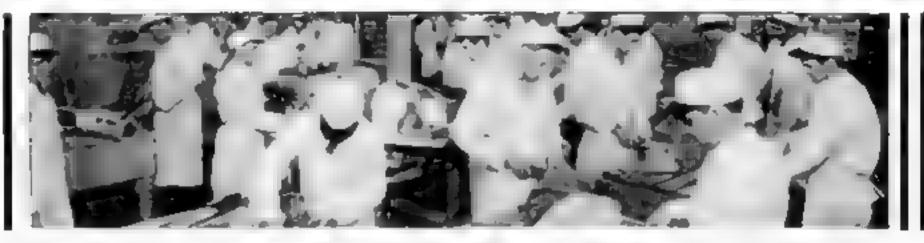
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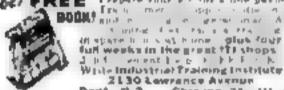
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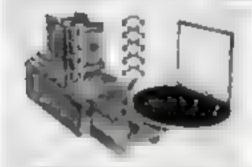
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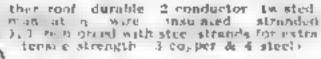




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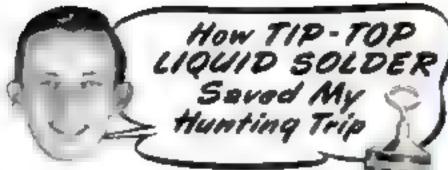
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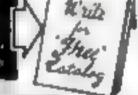
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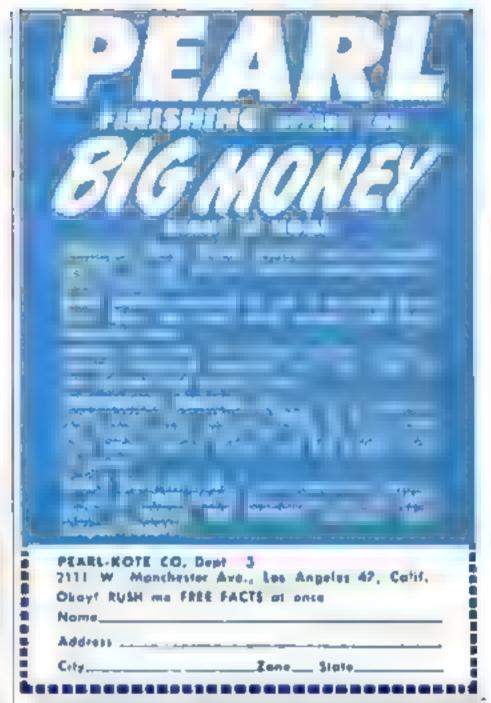
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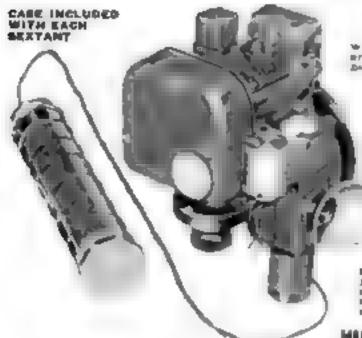
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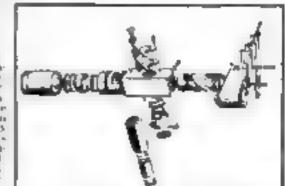
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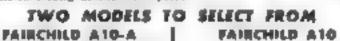


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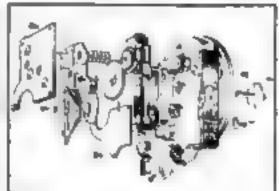
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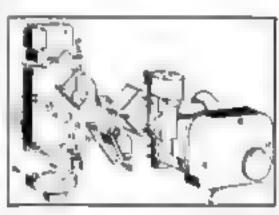


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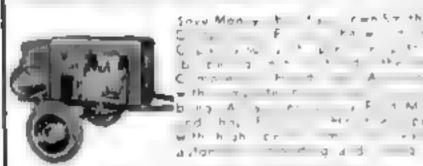
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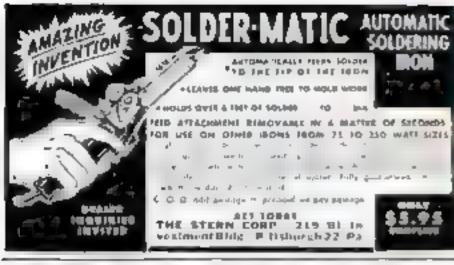
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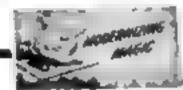
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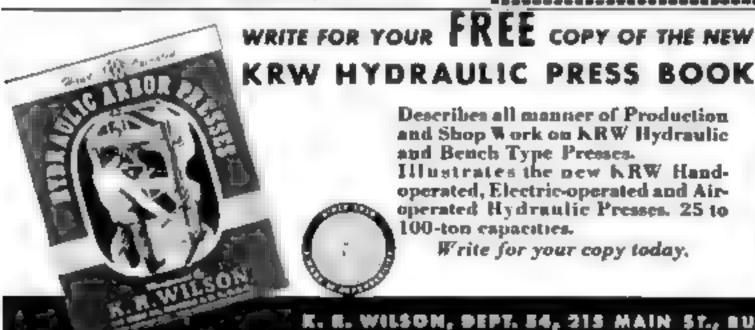


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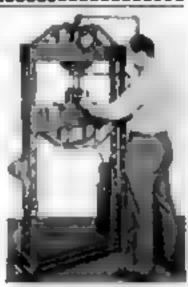


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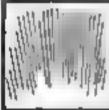
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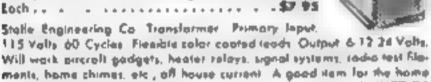
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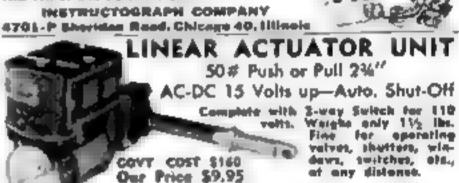
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# WHAT YOU CAN DO ABOUT PIMPLES

Acne, Blackheads, and other externally caused Skin Blemishes

HEN pimply skin is your problem, the first thing to get straight is that you can and should do something about it. To develop the attractiveness of your face is not mere vanity. It is an "open sesame" towards bringing the real YOU closer to other people and giving your personality the poise and confidence it needs. Your good qualities intelligence, character, dignity all go to naught... are completely cancelled out by a skin that "nobody loves to touch." Remember, the YOU that people see first is your face.

#### SKIN PROBLEMS DEMAND IMMEDIATE CARE

Medical statistics tell us that blemtished skin usually occurs from
adolescence on through adult life.
The problem at the adolescent stage
is serious enough to deserve attentive care as a family matter. In
adulthood, when life's responsibilities are so much weightier, it is
doubly important to exert great
effort to eliminate these blemishes.
And, there is no better time to get
pumples under control than now.

#### DON'T ABUSE SKIN

The first instinctive reaction to pimples and blackheads in to equeue them out

with your fingers. A bit of experimentation along these lines soon provides convincing proof that this succeeds only in inflaming your skin and spreading the infection. Under no circum-



stances should pimples and blackheads ever be squeezed.

Copyright 1949 by Darnol Products, Inc.

#### MICROSCOPE SHOWS IMPORTANT BASIS FOR EXTERNALLY CAUSED PIMPLES AND BLACKHEADS

Let's take a look through the microscope to see what a behind those unsightly pumples. The high-powered lenses show your skin coated with a covering which originated from two sources—one, internally and the other, externally

The internal substances on your skin include dead calls, residue from the invest glands, and a high quentity of oil excreted by the sebaceous glands. A most important factor in skin disorders occurs when thousands of these tiny sebaceous glands discharge more oil then the skin can use for lubrication. Unless special care is given, the oil forms a heavy film which attracts foreign matter to your skin much as any oil mop picks up dust. These infectious external substances may be classified into three general groups

- 1. Arrhorne materials such as dust, pollens condensation products of smoke, vapors, etc.
- 2. Materials brought in contact with the skin, such as tiny fragments of clothing, bedding, cometics.
- Micro-organisms such as bacteria and fungi.

See the difference between a healthy skin and a pimply skin in the microscopic reproductions below.





Mormal skin

Sick, pimply skin

Diagram A shows a normal-use, amouthly functioning subscious gland. Diagram B pictures sick, pimply skin. Notice that the sebaceous gland is a swellen mass of trapped oil, waste and infectious becteris.

#### TRY THIS SENSIBLE WAY

Two sensible sints to achieve in controlling this skin condition are: to clear the porce of clogging metter, and to inhibit the accessive oilsness of the skin. Toward these ends, Dornol Products' research makes available two formulas. One is to said in thorough cleansing by highly detergent penetration which simplifies the removal of waste and foreign marker. The other is to discourage colleges with clinicelly-proved ingredients, and to bill infections becterie often associated with externally caused pimples and blackheads.



To remove the distressing emberrasement of these skin blemishes, the second Dernol. formula exerts a "cover-up" action on your broken out skip while the medication does its work. This, plus its pleasant odor, will spare you the mental distress which is associated with unsightly, maledorous, medicated preparations, Imaginal You can apply this Dornel formula to your skin by day and face the immediate present with greater confidence in your appearance, while secure in the knowledge that medication is acting to remove old blemishes and keep away new ones. What this "coverup" action alone is worth in peace of mind is beyond calculation. No longer need prying eyes make you wince with humiliation and misery. Now because of this wonderful feature of the Dornol treatment, you can put your best foot forward . . at oncu!

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How to get the Dornal Treatment immediately: Just and your name and address to DORNOL PRODUCTS. INC., Dept. 4510-C, 4257 Katonah Ave. New York 66, N Y Be sure to print clearly. By return mail we will ship the Dornol treatment to you in a plain package. When postmen delivers the package, pay only \$1.98 plus postage. Or, if you wish to save postal fee, send \$2 now and we will pay postage. Which ever way you order, the DOUBLE REFUND GUARANTEE INII prevails. Don't delay another minute, sand for the Dornol Medicated Skin treatment with "cover-up" feature . . . at once! Sorry, no Canadian C O.D.'s.

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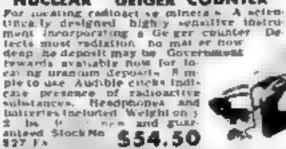
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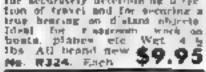


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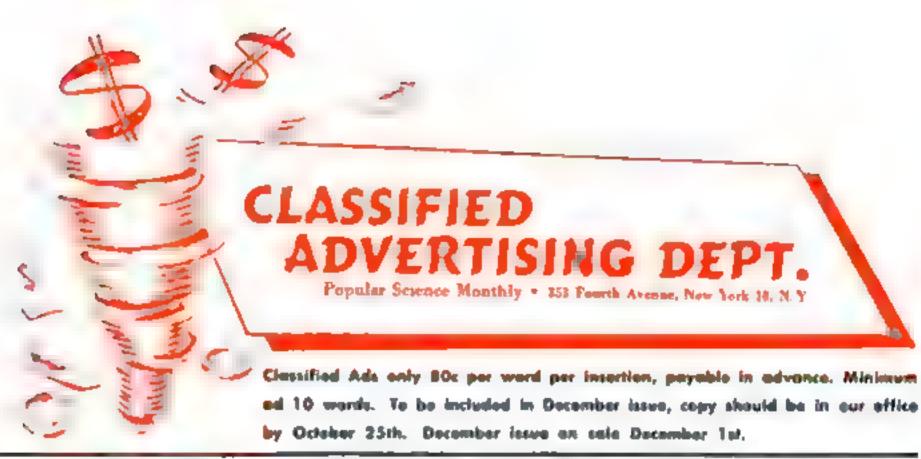
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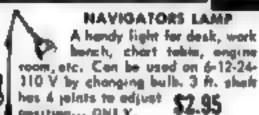
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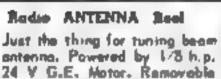
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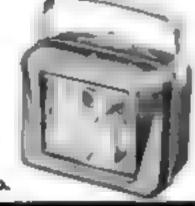
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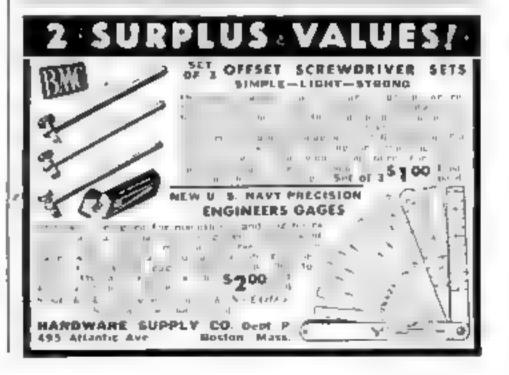
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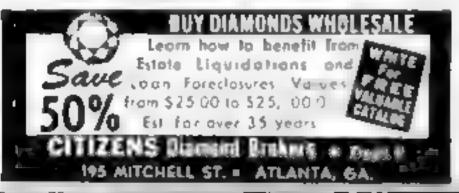
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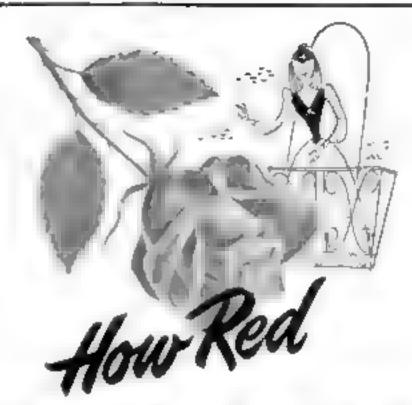
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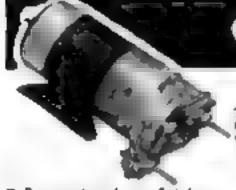


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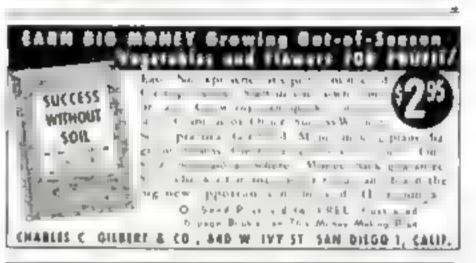


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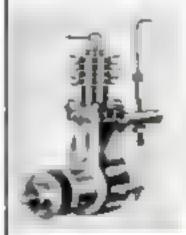
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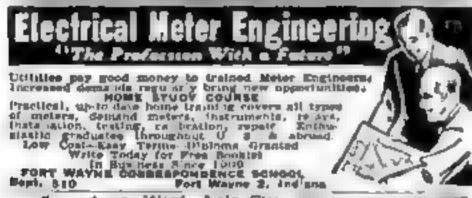
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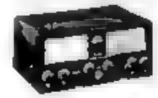
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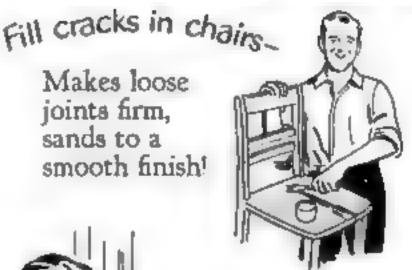
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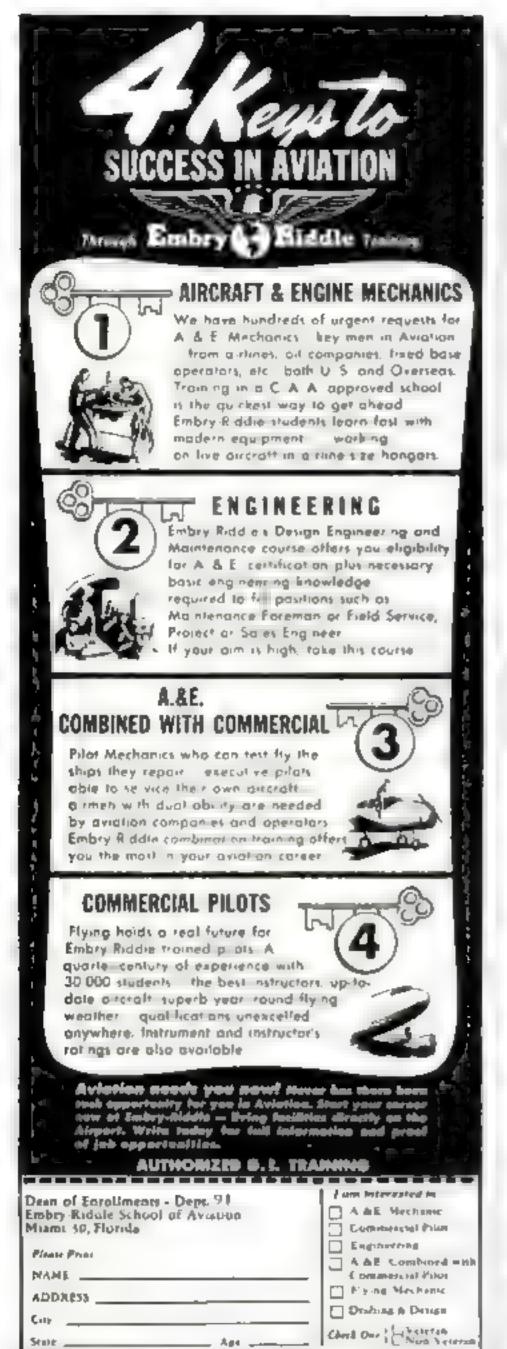
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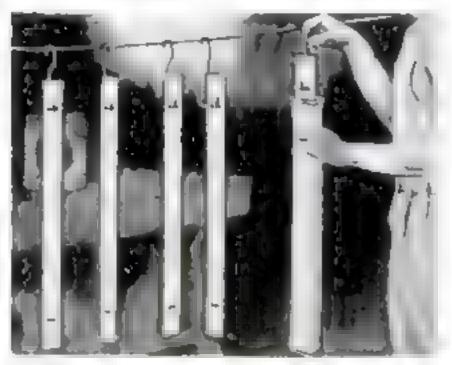




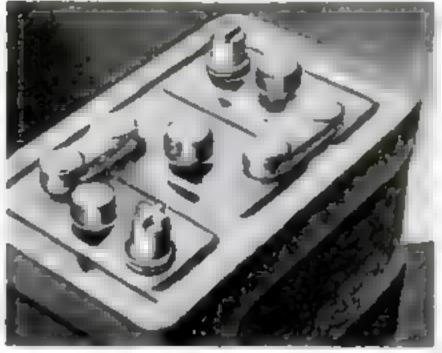
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Dipping vats for painting Venetian blinds. These could be of various depths to accommodate different length slats. One dip would paint each slat and they could be hung up to dry.—V. Hoffman, Springfield Gardens, N. Y.



Raised positive and negative symbols on autostorage batteries. Then it would be simple to identify the poles even if the battery were dirty and the poles corroded or marred by tools.— Harold Myers, Kennewick, Wash.

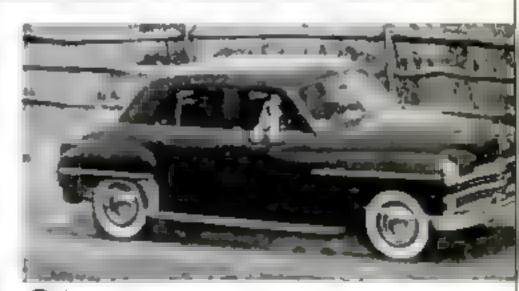


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## The car that likes to be compared

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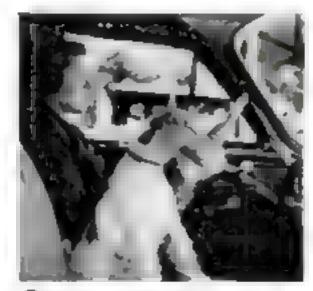
Yes, it likes to be compared for COMFORT, too!



with a new glide! The new Plymouth cradies all passengers between the wheels. It has airplane-type shock absorbers; a lower center of gravity; and a new diagonal mounting of rear shock absorbers that reduces sidesway.



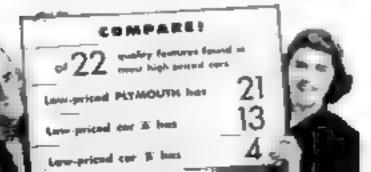
straight up—then comparel The new Plymouth gives you generous head and shoulder room where you need it. Chair-height seats are wider, deeper from front to back.



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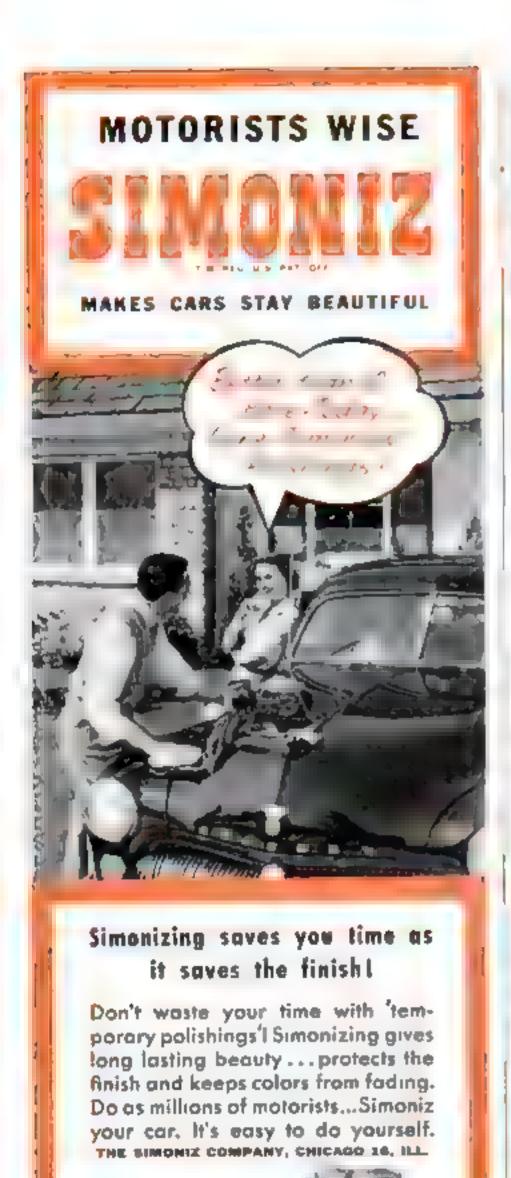
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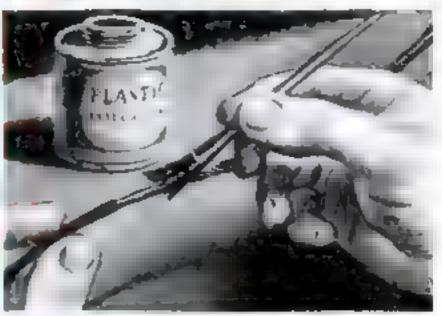




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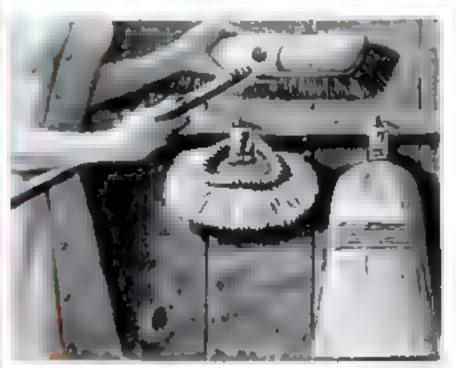


Plastic insulation. After you spliced two wires, such a liquid could be painted over the splice. When dry, it would be neater and less bulky than a wrapping of tape on the wires.—Ray Sherman, Belleville, Wis.



Offset posts for electric fences. Weeds and grass grow up and sometimes cause shorts. With the posts offset, you could run a mower beneath the wire or cut the weeds with a scythe.—

Archie Casebolt, Brooklyn, lowa.



One handle for broom and mop sets. The end of the handle could be threaded to fit various brooms and mops. Such an arrangement would be a space saver in most storage closets.—Sula Butler, Los Angeles.



RCA scientists develop new direct-reading Loran Instrument which simplifies problems of navigation.

## The homing pigeon goes to sea

Now science gives the navigator an improved "homing pigeon instinct," a way in which without checking sun or stars—he can head directly home.

Already thoroughly proved, Loran equipment has been simplified through RCA research and engineering, so that almost enyone can learn to use it in a few minutes. Free of human error, readings appear directly on the instrument. A quick check gives the ship's position.

Brain of the new Loran is a circuit

developed at RCA Laboratories which splits seconds into millions of parts -- accurately measures the difference in the time it takes a pair of radio signals to travel from shore to ship.

Given this information, the Loran navigator, hundreds of miles from shore, can determine his position quickly and accurately. Loran's simplicity adapts it to every type of vessel from merchant ship to yacht. Manufactured by Radiomarine Corporation of America, a service of RCA, it is already being installed in U. S. Coast Guard rescue ships.

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## Tomorrow's Workmen Need Better **Tools**



THE old saw that "a good workman never Leomplains of his tools" is too often used to excuse poor tools. It really means that a good workman won't put up with bad tools that make his job harder. So he begins a job by working on the tools before he starts on the work.

Only an expert, in fact, can make do with poor tools if he must. A beginner needs the best.

Yet, every day, some father or big brother tosses an eager youngster a bent screwdriver or a battered hammer and thinks he has done his duty.

Perhaps the worst offenders are the parents and doting uncles who pay good money for boy-size "kits" that even an expert would curse.

Saws of trush steel with "teeth" that hardly cut soap. Hammers with soft heads that come off on the first try-and handles of assembled splinters. Edged tools sharp enough only to cut young fingers.

The excuse for this slick junk is that it comes in small sizes-and real tools to fit small hands are hard to find.

This is a challenge to the makers of those good tools of which no good workman complains. And they have a bigger stake in the problem than fitting bigger hands. For it will be a sad day for this country when boys stop wanting to make something for themselves, of themselves, and by themselves.

The manufacturers have a double responsibility to make and merchandise tools for beginners. First quality tools, for young hands, that can wear the proud old labels. That can drive the junk back to the scrap pile.

If there are to be good workmen tomorrow, they must have good tools today.

Penny Githens



R. J. Republic Tabarca Co., Witehite-Salem, N. Q

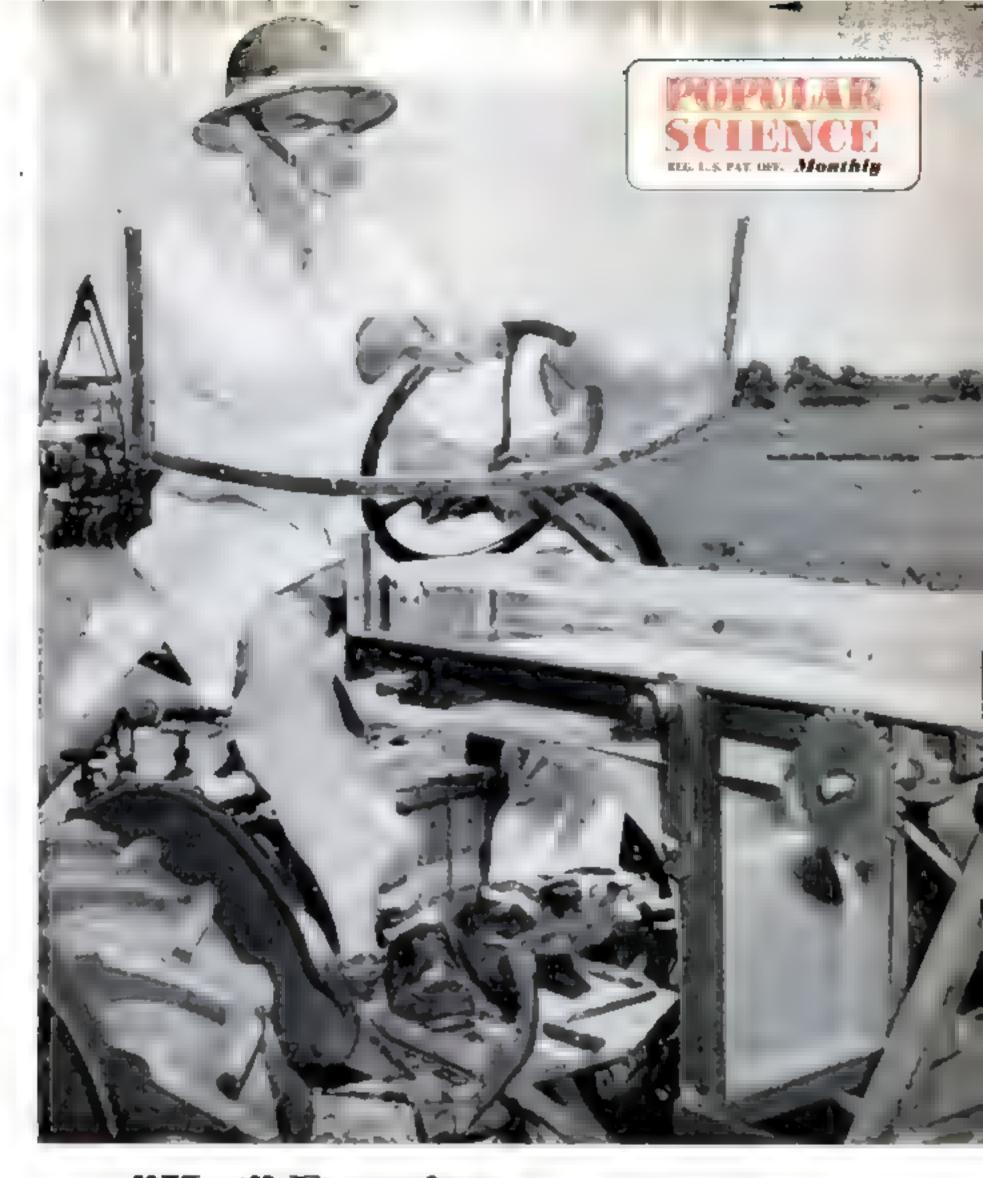


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farmer hot. The sun helmet is for shade, but the rubber gloves, respirator, special clothes, and shield are to protect him from the deadly effects of the radioactive phosphorus, mixed with other fertilizing agents, that he is spreading over the soil. With a Geiger counter, soil scientists at the Georgia Experiment Station near Griffin then trace the "hot" phosphorus in sample plants and determine the exact amount and distribution of the fertilizer they have absorbed. This helps tell farmers just when, where, and how much fertilizer to use for best results. To hold the phosphorus, the tractor is equipped with a special Plexiglas® hopper that provides a protective shield against its radiation.

# Scoop-Wing Plane





# Leaps off Lawn

Your gard can be your airport with two new planes that land or take off in a few feet.



Cover by Reynold Brown

#### By Devon Francis

PS photos by W. W. Morrus and Hubert Luckett

FOR a quarter of a century they have been talking about designing personal airplanes capable of landing on and taking off from a piece of real estate no bigger than a tennis court. Small airplanes, airmen argued, had to do that if they were going to have any utility. Hundreds, if not thousands, of false starts have been made on that kind of a flying machine.

Now, at long last, it looks as though they

are getting somewhere.

Two new experimental planes promise to fill the bill. Both have "fixed" wings, like other airplanes. Both would let their owners fly to and from any place boasting a sizuble lawn, not just between airports. Neither has the helicopter's costliness or its complexity.

One, called the Helioplane® (to liken it to a helicopter in performance), lands in half the width of a city lot, against a 25-m.p.h. wind. It takes off, in the same wind, in 50 feet. It requires about twice that when there's no wind.

The other plane is called the Paraplane® (to liken it to a parachute in performance)

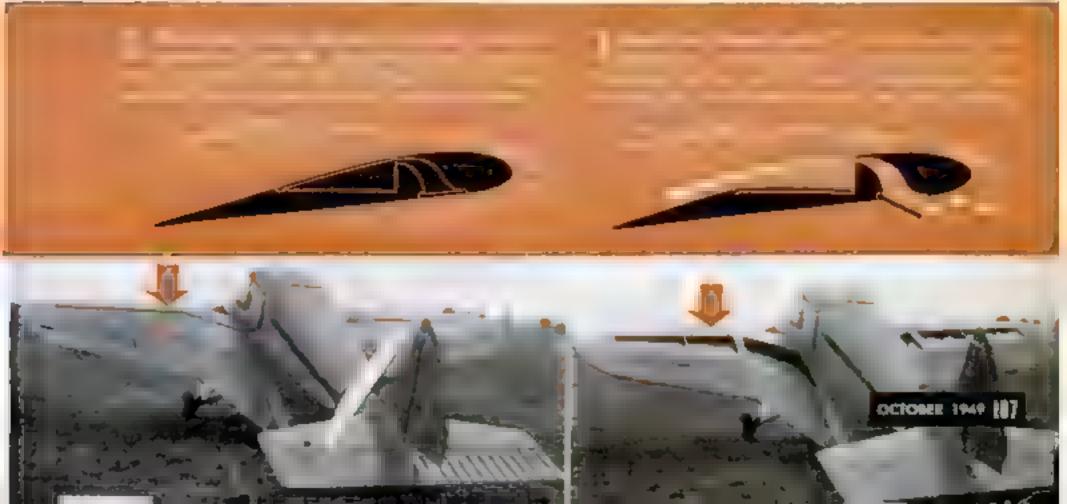
Its designer expects the production version will at least equal the Helioplane.

By contrast, present-day standard lightplanes cruising at 100 miles an hour or better require several hundred feet for landing in still air and somewhat more space for taking off-unless there is a crackerjack pilot at the controls.

One of these two new planes was built by a couple of college professors, the other by the son of the man who invented the icecream cone. And, weirdly, the ice-cream cone had more than a little to do with the design of that second airplane.

Except in performance, and the fact that both have been built on a financial shoestring, the two planes have little in common. One looks like almost any other lightplane. The other resembles a vest-pocket edition of a gull-wing Navy fighter. But both have fantastic angles of climb and descent. And both are as well-behaved at low speeds as a hobbled lamb.

The Paraplane (which is pictured on the cover of this issue of POPULAR SCIENCE) has the more romantic background. The inventor, Edward M. Lanier, and his father, Edward H. Lanier, both unreduemed and hightplane design, experi





Batlike configuration plus gull-wing dihedral helps Paraplane's lift, aids stables At root wing chord is 10 ft. Wing loading is 12 by the imported with the usual and tpunes 7 or 5 lb.



Pencil points to bank of jets through which air streams from scoops in front. Maximum depress in of doors, which cover third of wang tree varies from 8 in, inboard to 15 in, at tip.



Scoops take in air, also change contour of wings lower surface, boosting lift. Their maximum opening ranges from 6 in, to 2 in. Wing area is small—100 sq. ft., about half usual area.



Control for scoops and doors is ludden at right in experimental cockpit. Power is from Continental 90-bp., opposed-cylinder engine. It turns ordinary propeller at 2,300 r.p.m. for cruising.

mented for years with odd-looking flying machines. They got the idea for a cell of low-density air in the top of the wing right out of the ice-cream cone that the elder Lanier invented.

Ruminating on the cone, the Laniers dropped weighted paper cups from the window of a 12-story building. Some of the cups were open at the top, some were sealed. The sealed cups beat the open cups to the ground.

Here's why. A low-pressure area forms inside an open-top cup on its way to the ground. It falls too fast for the surrounding air to flow inside and maintain normal density. Thus the low-pressure area slows the cup's fall by creating added lift.

Lanier figured he could get the same kind of added lift by building big holes in the tops of his Paraplane's wings. The holes create a greater-than-normal low-pressure area—a mild semi-vacuum—on the wing surface while the plane is descending. The reason for that is the same reason that most airplane wings are bulbous in front. The air has to speed up to get over the bulge, and when it speeds up it gets thinner. An airplane flies only because the air speeding across the top of the wing is thinner than normal. The air below the wing keeps trying to push up into this semi-vacuum. That creates lift. In this way, some threefifths of the lift generated by a wing in flight comes from the top surface. The rest results from the "planing" effect of the bottom of the wing on the air-the same thing that makes a flat stone skip along the surface of water.

Thus the Paraplane uses its wing holes to supplement ordinary lift. The pilot creates the holes merely by pushing a lever in the cockpit. The lever opens doors in the tops of the wings. By releasing it, he can make the wing tops again as smooth as those of a conventional airplane.

That's only half the trick Lanter performs with his wing. Some amplanes have slots on the leading edges of their wings, amounting to a secondary leading edge. These slots control a very thin layer of air flowing close to the wing surface. Known as the boundary layer, this air must wash the wing smoothly for lift to result. But at low speed, or when the wing is tilted up sharply, the boundary layer tends to separate from the wing too soon and "burble"—thereby sacrificing lift

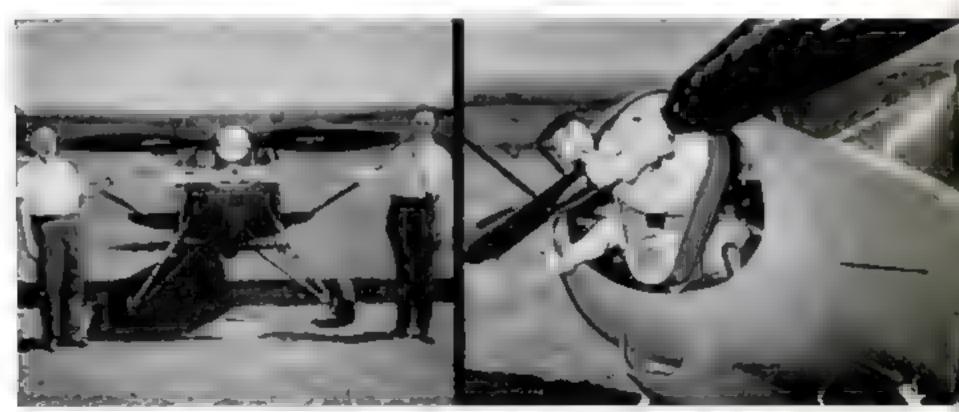
and increasing drag. It is the boundary layer that gets out of control when a "stall" develops. Slots help prevent stalls. Air streams through them, washes back over the wing, and re-establishes part of the lost lift.

Lanier attacks the problem of boundary-layer control—but in a different way. Instead of slots, he has scoops just under the leading edge. They serve the same function. By making the scoops big and their outlets on the wing top mere slits, he gets a venturi effect. Compressed by the restricted space, the escaping air leaves faster than it entered. This helps control the obstreperous boundary layer and provides the Paraplane with added lift.



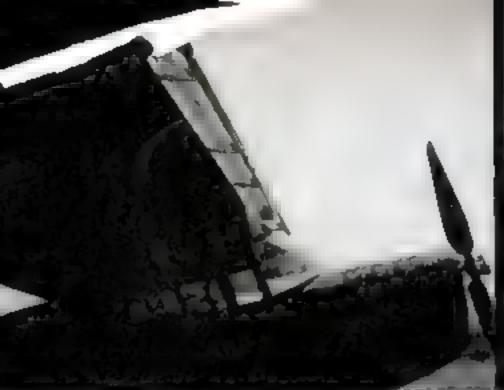
Second high-performance ship, Helioplane, takes off at spectacular clumb angle without danger of stalling. Plane's 20-foot span is normal, but length is 4 ft. greater as aid to stability.

Wing is from standard Piper Vagabond with 5-ft.-3-in. cliord. Goodyear landing gear casters for crosswinds. Plane was built for two college professors by Wiggins Airways' Joseph Garside.



Big 9-foot Aeromatic propeller (PS, May, '48, p. 164) dwarfs standard 6-foot prop. Performance depends on area covered, goes up as square of length. Engine is fuel-injection Continental.

Reduction gear lets engine turn 2.3 to 1. Prop turns 1,200 revs maximum and 1,080 at cruise. Inventors stress that the minimum speed, unlike most planes, is above wing's stall point.



Full-span automatic slots give Helioplane boundary-layer control at high angles of wing attack. Pilot retains full control at 30°—twice the angle of climb that ordinary wing will permit.



Flaps and spoilers also contribute to extraordinary control characteristics. Full-span flaps are also ailerons, responding to suck at any setting. For present, spoilers are experimental.



Innovation in Helioplane is lack of vents in cowling for escape of air taken in to cool engine. Instead, air is routed through exhaust pipe and into "hush-box," above, reducing noise level.

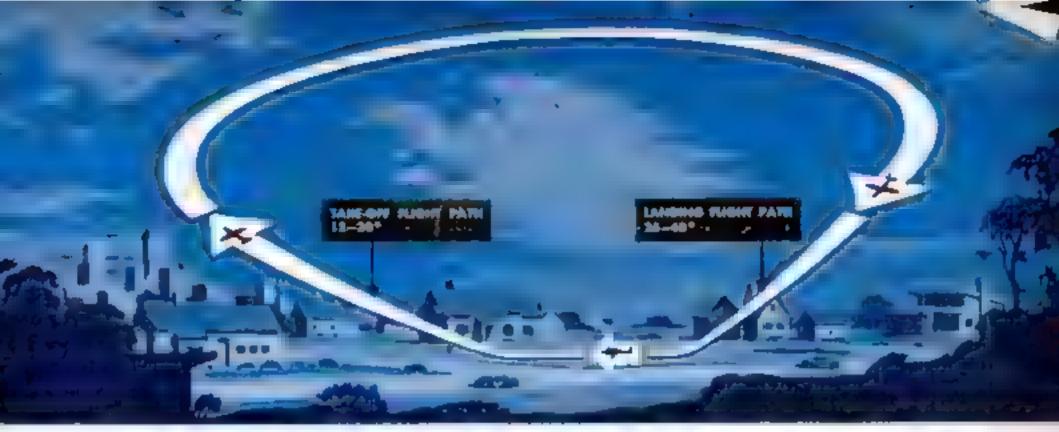


One of plane's neat problems was yaw at low speed—tendency to turn opposite to bank. This was remedied by splitting rudder Bottom half is linked to ailerons, top half to rudder pedals.

So much for the Paraplane. The new Helioplane is something else again. Being flown at Norwood, Mass., it is the brainchild of Otto C. Koppen, professor of aeronautical engineering at Massachusetts Institute of Technology, and Lynn L. Bollinger, former transport pilot who is now professor of business administration in the Harvard Business School. On Professor Koppen's own statement, this airplane incorporates nothing new in lightplane design. What it does do, however, is combine known principles of flight in a new way.

It has slots. It also has full-span flaps on the trailing edge of the wing. Flaps are no novelty; all transports have them. They momentarily change the shape of the wing, giving more lift for take-off, or high lift and added drag for landing. The Helioplane also has spoilers, the gimmicks used on gliders to disturb the boundary layer and decrease lift for landings. The Helioplane's spoilers, unlike a glider's, respond not to a separate control but instead to the control stick. They are being used experimentally for added lateral control at very low airspeeds. If a wind gust pushes a wing up, the spoilers open up on that side of the plane to kill part of the lift.

But the Helioplane's most unusual feature is a huge propeller geared down to turn at about half engine speed. The reason for that is based on the same fact that makes pilots of jet airplanes cautious about their airspeed in landing and taking off—a gas moving at high velocity doesn't provide much thrust at low aircraft speeds. The gas displaces too much air too fast.



Steep descent and climb, low speed of new experimental pages make good size of lawn and

any it Even's several hundred feet of "free-



Present-day lightplines, in like Para lane and Historian lack into the most flat acquire low

approaches and several handred feet of take offfacility space when there is no wine to help.



Among attempts to produce useful personal aircraft base been Curtess Timerer (left) win-

her of 1929 v 100 000 Gaggenhern contest here ups (center curved-wing job (right) The reverse is also true: a big volume of air displaced at low velocity provides a lot of push at low aircraft speeds. The average lightplane's propeller threshes the air with a considerable loss of thrust until flying speed is attained. By contrast, the Helioplane's big, slow propeller gives ample, instantaneous thrust right away.

The giant prop helps another way, too. Any schoolboy knows that an airplane's wings derive additional lift from the backward "prop wash." That's why propellers are mounted as they are on transports. The Helioplane's propeller covers much more wing area with backwash than does that

of the conventional lightplane.

It is not abusing the meaning of the word to say that both the Paraplane and the Helioplane perform sensationally. I watched both of them fly. The Helioplane will float along level without losing altitude at less than 30 miles an hour. In its present form the Paraplane will do the same thing at something above 30 miles an hour.

The Paraplane, based at Marlton-Medford airport in western New Jersey, took off with a run of less than 200 feet, against a choppy wind of perhaps 20 m.p.h. It landed with a run of about 150 feet. In itself, that wasn't too impressive. I've done that in a Piper J-3. The Helioplane performed a lot

better against a 25-mile wind.

#### Paraplane Climbs Like Rocket

What was impressive was the Paraphine's rockethke rate of climb and sharp angle of descent. Moreover, Lanier says that his experimental airplane is 225 pounds overweight, beefed up for its tests, and that his production job will land in less than 100 feet and take off in 100 feet.

Both airplanes are described as spinproof. Each will cruise at 100 to 110 miles an hour.

As a run-of-the-mill lightplane pilot, I have three criticisms to make of the Helioplane, one of the Paraplane. The Helioplane's owners are touchy on the subject of the meager ground clearance of their propeller. They can well be. Because of the size of the prop, the machine must be taken off and landed tail-low to prevent damage to it. That fault could be mended with a slow-turning three- or four-bladed prop. Second, because the Helioplane is so eager to fly, I suspect that it would prove difficult to handle on the ground in a high wind unless it were fitted with a tricycle landing gear to provide the wing with a slightly

negative angle of incidence and kill its lift. And finally, I wonder whether the high efficiency of the plane's engine-propeller combination at low airspeeds is only at the sacrifice of efficiency at cruising speeds.

The Paraplane is outside my experience. But it struck me as providing too little visibility for the pilot in the landing maneuver. In landing a conventional lightplane, the nose is down on final approach, giving the pilot a good view. But the Paraplane must be nose-level or nose-high throughout the final approach to get the benefit of the vacuum-generating wing. The pilot sits high and forward in the ship, in fact, for just that reason. Even so, his visibility, vital to safe flying, must suffer.

#### New Designs Promise Wider Market

Both the Helioplane and the Paraplane, put into production, unquestionably would boost the use of personal aircraft. The record of lightplane ownership in the U.S. is a glum one. After a brand-new pilot with his brand-new airplane exultingly has taken his family and friends for a ride, he finds himself wondering what to do next. He can't drive his mount to Aunt Martha's across town. He can't use it to go to the grocery store. Every time he lands at an airport he must find motor transportation into town. The general rule has been that after a year or so he sells his plane in disgust.

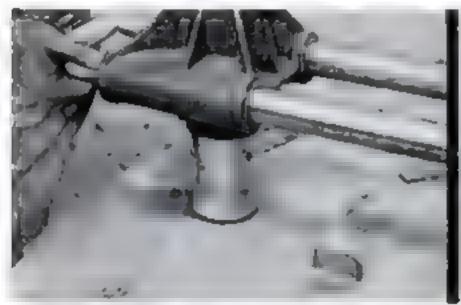
Lightplanes that will get into and out of tight places—that will fly off your lawn—will have a much greater utility. They will give more for the invested dollar. Lanier even proposes to put folding wings on his craft so it can be hangared in the family garage. Lightplanes probably never will whip the weather bugaboo, the main bar to all-around usefulness, but the new experimental designs should release them from the restrictions of the airport.

#### How Many Colors Do You See?

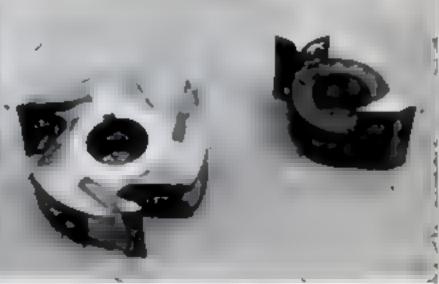
SEVENTEEN thousand distinct colors are visible when observations are made with a precise optical instrument. To this figure Dr. David L. MacAdam, of the Kodak Research Laboratories, adds the fact that when large pieces of colored paper are observed with the naked eye, roughly 50 per cent more colors can be distinguished than by the finest optical means. Dr. MacAdam estimates that there are about 250 distinguishable colors in the spectrum, plus 10,000 distinguishable tints of spectral colors and 7,000 non-spectral colors, such as purple.



Router bites away at stump 68 inches across. Block at right of machine is counterweight.



Close-up above shows steel cutter head, 3% inches in diameter, ready to tear into the stump. Whirling at 5,200 r.p.m., it chips away an area 2% inches wide and 1% inches deep.



Stump remover has two types of steel cutters. The three-bladed one, left above, is used on smooth-grained wood; the two-bladed one, right, chews right through hard, knotty areas.

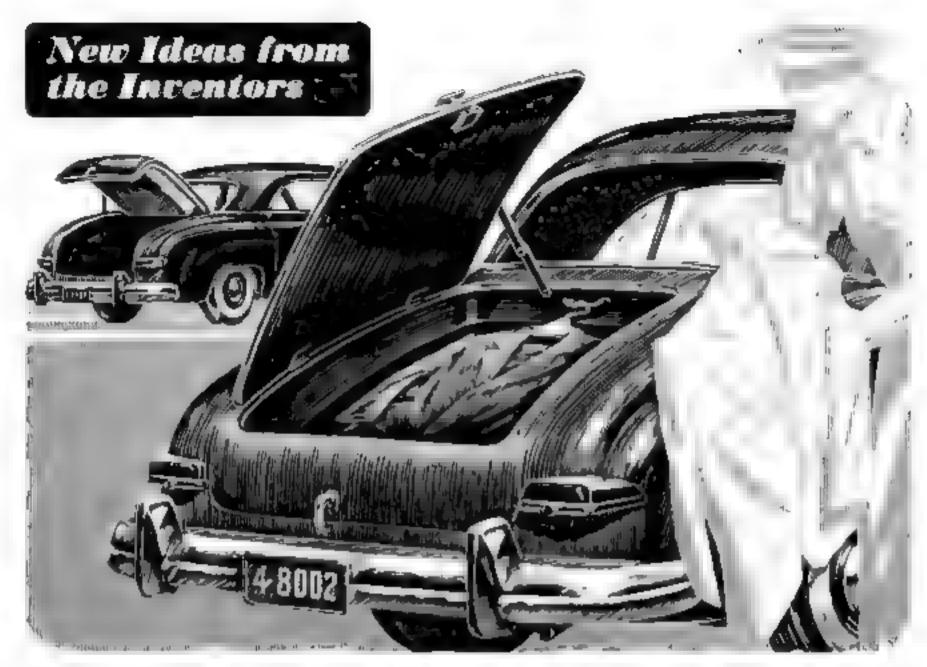
#### Steel Beaver Chews Out Stumps

THE steel "teeth" of this machine can rout out in 10 hours a big tree stump that would take you 10 days to chop out by hand. Fastened to the center of a stump, the machine is rotated by hand while a revolving cutter chews away the wood. After a cut is made all around the stump, the operator unlocks a radial brake and pushes twin bars, on which the motor assembly is mounted, toward the tree center for another rotation. A spindle, with a six-inch stroke, permits adjustment of the cutter to an uneven surface. Powered by a 2%-hp. electric motor from a portable generator, the Stump Beaver® routs out a stump to any depth. In-



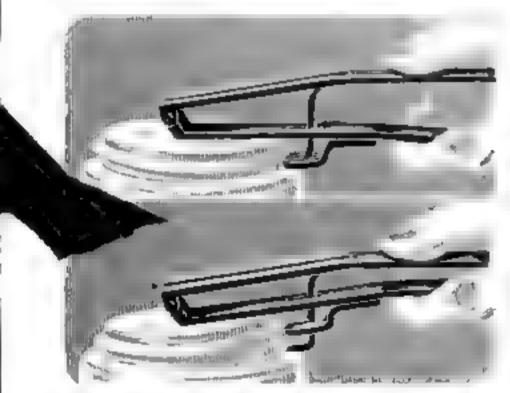
To cut down the stump's center part, the machine is remounted at the side of the stump on an adapter platform, which raises the device up to the surface of the pole for cutting.

vented by Walter S. Spott, of Verona, N. J., it is still in the experimental stage. END

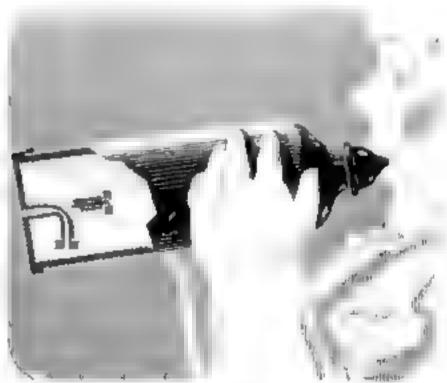


Car Trunk Packs Clothes Flat.
Auto travelers wouldn't have to pack their clothes in suitcases or hang them up inside the car with this special compartment. A shallow tray with its own door built into the

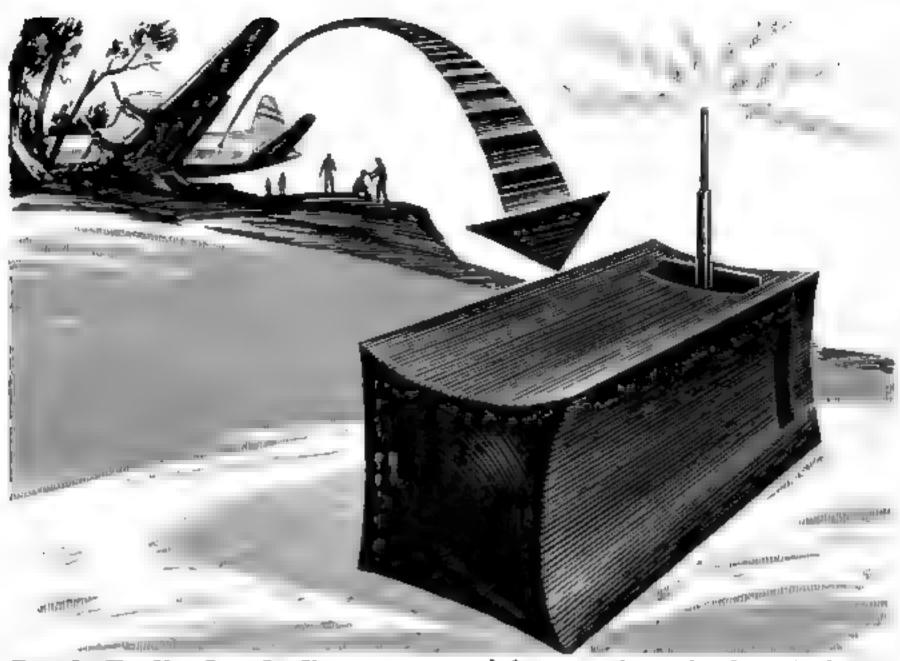
lid of the regular luggage compartment, it permits suits and dresses to be carried flat and unfolded so they won't wrinkle. Patented by S. W. Ford, of Dayton, O., it takes little space, leaves the usual room for luggage.



Opener Pries Off Jar Tops. Easier opening of jars with pressure caps is the object of the opener invented by N. Eastman, of New York City. A fork on the lower handle hooks under the lid's edge. When lifted up, this pries off the cap while a foot extending down from the upper handle rests against the jar's shoulder for leverage.

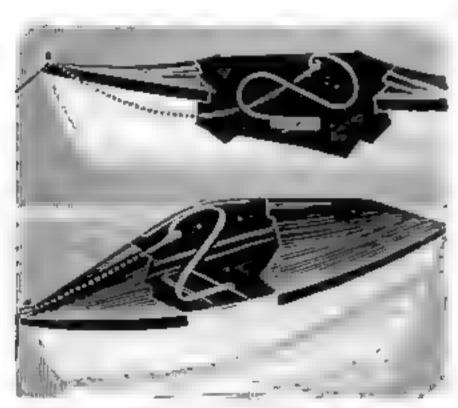


Tube Vents Baby's Bottle. Babies would get milk, not air, out of this bottle. When a vacuum begins to form, outside pressure forces in air through a flexible tube in the bottom. A weighted collar keeps the tube bent over to close it until the pressure builds up enough to straighten it out. The inventor is R. M. Soper, of Tacoma, Wash.

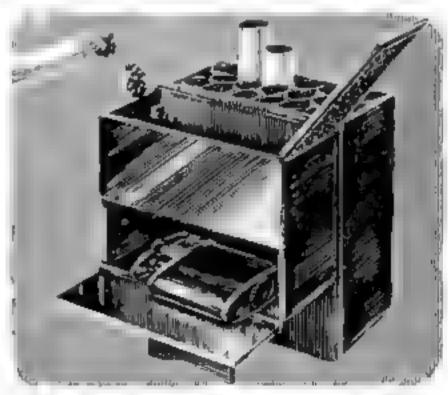


Crash Radio Leads Itescuers. If an airplane crashes, this shock-mounted radio transmitter is designed to be ejected by an explosive charge set off by the impact. Safely away, it then sends out distress signals

to help rescuers locate the plane. A telescoping antenna, pivoted inside like a pendulum, automatically slides out of a slit in whichever side comes to rest on top. The inventor is C. J. Camp, of Palo Alto, Calif.



Spring Supports Boat Cover. Heavy boat tarpaulins could be put on easily with the S-shaped leaf spring patented by F. D. Burns, of Muskegon, Mich. The cover is put on loosely with the spring compressed. Pulling a rope tied to the top of the S forces the spring upright, tightening the tarpaulin and raising it up so water will run off.

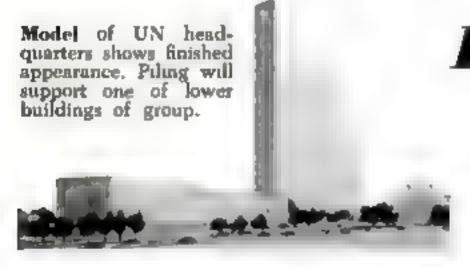


Case Meets Smokers' Needs. In addition to holding a full pack of cigarettes, this novel container has a compartment for a lighter or matches and a built-in ash tray. When moistened with water, a strip of blotting paper on top of the ash-tray lid helps keep the tobacco from drying out. The inventor is V. Trinko, of Downers Grove, Ill.



1. After hig mobile pile driver has been maneuvered into place on endless tracks, cable is attached to long steel pile, and rig swings it aloft, to stand on end for driving to bedrock.

2. Men scrambling up rig, to help guide pile, give idea of its comparative size. But even this big pile driver is far from largest of type, giants that have driven piles 194 feet in length.



# Big Hammers Speed Job of Pile Driving

#### By Alden P. Armagnac PS photos by W. W. Morris

THERE'S more to driving a pile than brute force—it's an art that experts write whole books about. These pictures of how a big, modern pile driver does its job give you an idea of the skills involved.

Largest of several in action on the site of the United Nations' future New York City headquarters, this steam-hammer pile driver is sinking steel piles as underpinning for a low building of the group. The whole construction project is being carried out by leading contractors associated under the name of Fuller-Turner-Walsh-Slattery, Inc.

Steam-hammer pile drivers have almost entirely supplanted the old-fashioned drop-

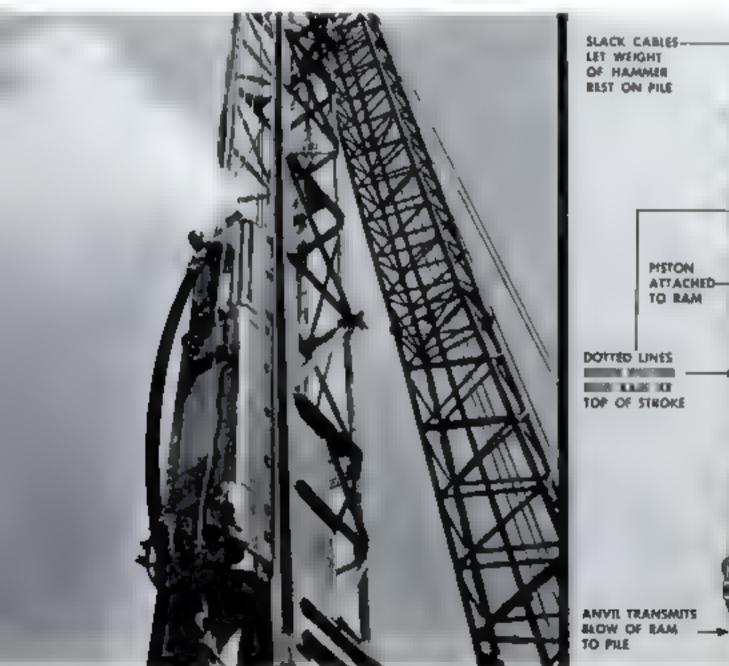
hammer kind, which hoisted an iron weight of a ton or so to the top of a derrick-like frame, and then dropped it on a pile. A steam-hammer rig is a simple form of steam engine, using a piston in a cylinder to raise the striking weight or ram. Drop hammers can deliver five to six blows a minute; steam hammers, 10 to 20 times as many, driving more piles a day with less damage to the piles and, through vibration, to nearby foundations and structures.

Single-acting steam hammers, like the one shown here, use a ram of 3,000 to 14,000 pounds that falls by gravity from the top of its approximately three-foot stroke Double-acting steam hammers add steam pressure to force of gravity to propel the ram downward, permitting a lighter ram, a

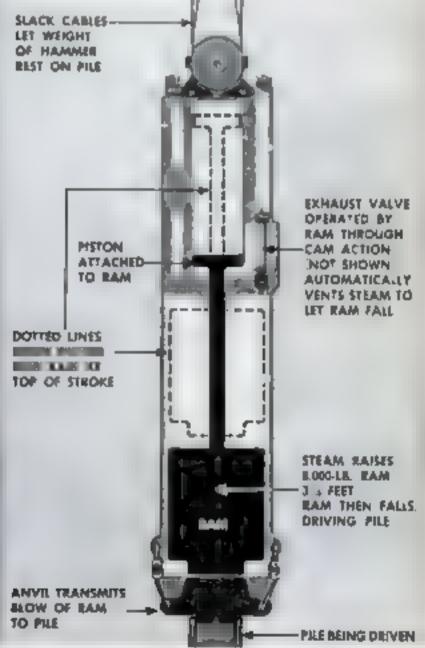


3. Worker drops rock to leck position of right very right spet. Seen just above him my lof steam manner is to bled to lit and engage H-shaped and at pile that had an ere will raise.

1. Pile now stands vertically on ground ready to be driven. Whole weight of steam harmer rests on its top end. Hoisting cables of hammer are slack, and hammer will follow pile down.



5. Fifty-five clanging blows a minute from four ton rain of steam-spoutage bonnor drive pile home. Rapid at first progress gradually slows, ending when pile reaches bedrock.



6. Inside view of steam harmor shows how piston ruses rum, which trips exhaust valve and fills against aixed, driving pile. Operation is automatic so long as operator feeds steam.



7. Sunk to "refusal" or until they will go no farther, these piles have come to rest against bedrock, deep below the surface of the ground. Because of irregularities in the underlying rock

strata, some piles are left projecting farther than others. All will be cut off evenly, before concrete is poured over them in the boxlike forms seen in the illustration above.



8. Trimmed off with cutting torch, ends of sunken piles clearly show their H-shaped cross section. Except for their uniform thickness throughout, they resemble structural girders.

9. Flat plates, welded to tops of piles, serve as bearing surfaces to support weight. Piles now are ready to serve as underpinning for reinforced-concrete foundation of a building

shorter stroke, and more blows per minute. However, builders sometimes prefer and specify the heavier single-acting type because the force of its blows is absolutely uniform, depending on gravity alone and being unaffected by varying pressure of steam supplied from the boiler of the rig.

Types of piling include timber piles; concrete piles, either precast and driven with the aid of protecting metal caps, or cast in place within driven steel tubing by several patented methods; and, more recently, steel H beams. The last are finding increasing favor, especially in hard-to-penetrate ground such as is found at the UN site.



10. Network of reinforcing bars, laid over capped tops of piles, is being wired together above. Final step of pouring in concrete makes piles an integral part of building they support.



#### **Ball-Out Net Trains Pilots**

Pilots learn how to bail out of a speeding plane by making practice jumps on the ground into this new type of net. In use at the Naval Air Station, Alameda, Calif., the net stretches above the plane's wing just below the cockpit rim and turns upward at one end to keep trainees from overshooting it or rolling off onto the ground. Old-type nets were lower and flat, causing occasional injuries. The jumps are made with the plane standing still but with its propeller turning to provide a realistic airstream.



Ridden like aquaplane, motorized Skim Boat® hits speeds up to 35 mp.h. Unsinkable, it is steered by pulling on hand ropes that run back through side rails to tiller near rear of sled.



Watertight, aluminum compartment (right, above) forms how and houses 7%-hp. outboard engine. Sled, which hooks on behind, comes apart in sections for easy carrying in car trunk.

#### Outboard Powers Aquaplane

You don't need a boat to pull this aquaplane. A 7½-hp. outboard engine, housed in its metal prow, speeds it over the water at up to 35 m.p.h. Placing the engine up front keeps spilled riders from falling backward into the propeller. And if a rider falls off, letting go of the steering ropes automatically stops the motor. Hansen, Inc., Bryth Mawr, Pa., makes the Skim Boat<sup>®</sup>.



Weighing only 120 pounds, including engine, sled is 90 in. long, 24 in. wide, Engine's propeller (right) protrudes into water below metal nose, Fin near sled's stern (left) is steering tiller.

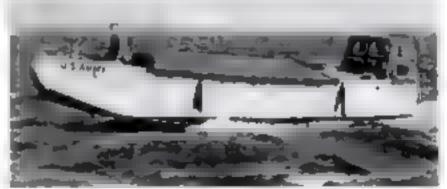


Here's how the Army's come-apart cargo launch looks with its three sections disassembled.

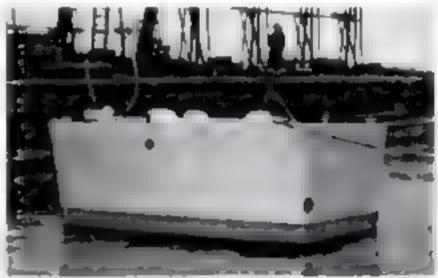
#### Come-Apart Boat For Arctic Army

O's THE varied terrain of the Arctic, boats are as essential Army equipment as tanks—but they must have overland mobility. That's why this 32-foot eargo launch is built in three sections. Only eight bolts connect the three parts, making possible assembly or disassembly in a few minutes. The bow and center sections weigh less than 800 lb. each, while the stern unit, including the 60-hp. engine, weighs about 1,600 lb.

The all-aluminum boat, built by Edo Corp., of N. Y. C., for the Army, is especially designed for the Far North. Except for the V-shaped section, the bottom is flat, with two runners to facilitate skidding across the ground. Drawing only 24 inches with a load of 5,000 pounds, the boat is ideal for operations in shallow waters. The propeller, located in a semi-tunnel, is protected from damage against rocks. The upswept bow permits the craft to be beached under its own power.



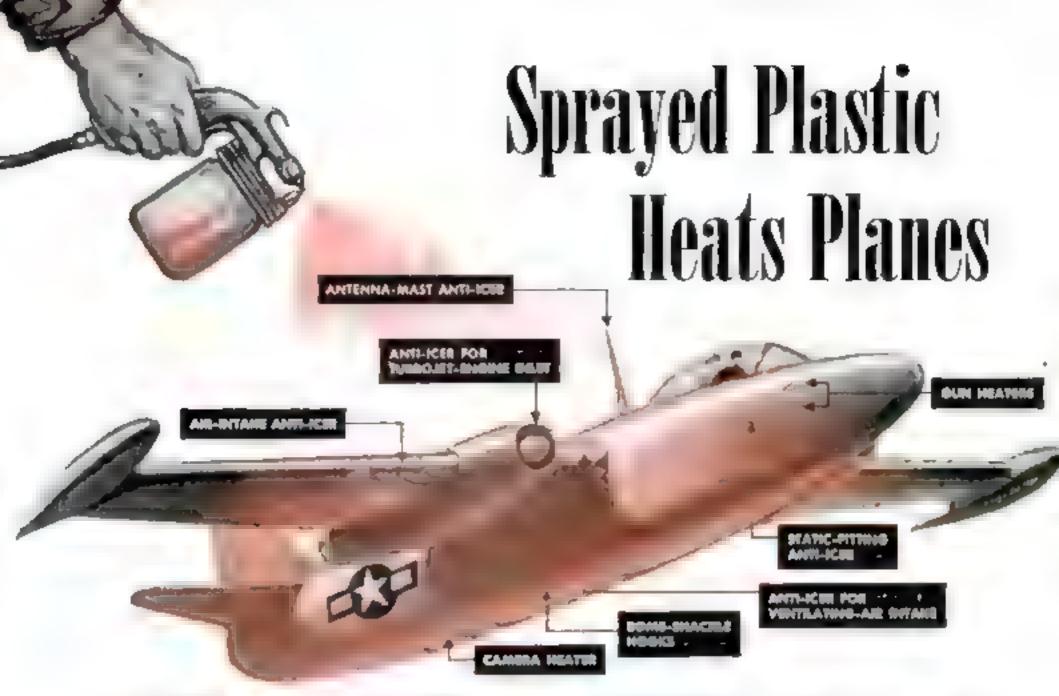
Assembled and launched, the boat has a speed of 10 miles an hour. The enclosed helmsman's cockpit in the rear can be heated for Arctic operations. Canvas canopy covers cargo space



The rear section, shown above, contains all the controls and the gas engine in a weather-proof compartment. It can be used separately as a marine tractor for moving rafts or barges,



Fully assembled, the sectional launch can be transported in a Fairchild C-82 Flying Boxcor.



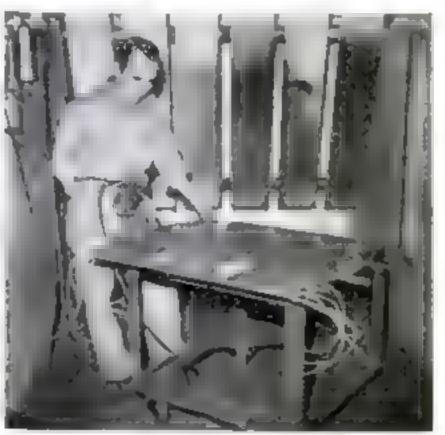
PATCHES of plastic, some thinner and smaller than a postage stamp, are being used to keep ice from forming on vital parts of airplanes and to keep guns warm. The secret: a special type of electrically conductive plastic that acts as a heating element.

Applied to anything that would suffer from low temperatures, the substance, called Electrofilm<sup>®</sup>, becomes a covering so tough

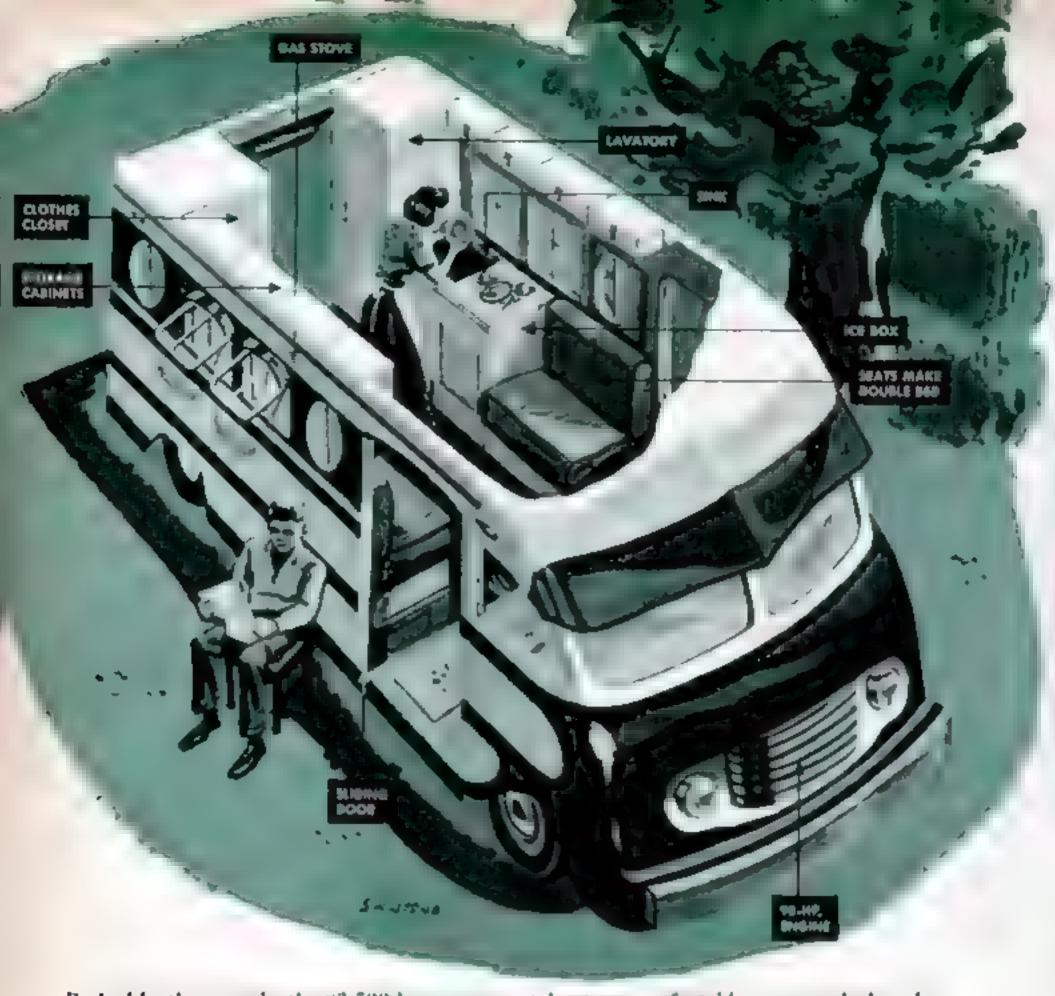
that sandblasting is required to remove it. When electricity flows through it, it heats up, warming aircraft antenna masts, accessories of jet engines, cabin air intakes, bombshackle hooks, and the cold-affected parts of guns. Weighing less than an ounce a square foot, it can produce temperatures up to 600° F. It was developed by the E, R. Hall Co., of North Hollywood, Calif.



Electrofilm cemented to bucket bottom and electrically energized hoils water in a few minutes. Formulas vary. One type can be applied in watt densities up to 250 to the square foot.



The thermosetting plastic may be brushed or sprayed on. Here wing for wind-tunnel model plane is being treated. Usually applied over varnish, film thickness varies from .003 to .02 in.



Parked by the wayside, the \$3,500 house car is at least as comfortable as a roadside cabin.

Backing up or parking is only a little barder. than in a conventional passenger care liver's a full length sliding door on each side fiven rear view mirrors show onver his side exarance.

Big windshield incomish independent seats give fine forward visibal to Map table in front is big anough for a chied to sleep on. Over wands are day a large strage locker



### Road Cruiser Made from Light Truck

PS Photos by W. W. Morris

COMMON delivery tracks, like the ones your laundryman or baker use, are being converted into "roadable homes" that may soon appear in numbers on U. S. highways. They combine in a single vehicle the housing conveniences of a large trailer, the roadability of a passenger car, and the ruggedness of a truck.

A house car isn't a new idea. Occasional ones have been custom-built for wealthy owners, usually on a bus chassis. Bulkiness, high first cost and fuel bills, and licensing complications have kept their numbers down. Now the Boyertown Auto Body Works, Boyertown, Pa., has begun to make "touring coaches" as a modification of its light delivery truck.

Boyertown house cars use a Ford F-3 chassis having a 122-in, wheelbase. Overall dimensions—18% ft. from bumper to bumper and 7 feet wide—are about those of a large sedan. In most states passenger-car license plates will serve. Gasoline consumption depends on load, road, and speed, but averages around 10-14 miles per gallon.

The cab is entered through shding doors. A third door is in the center of the back. Two trailer-type windows and two fixed-

glass portholes in each side light the interior of the body. Further ventilation is provided by air intakes up front, a rear window, an exhaust fan over the stove, and a hinged roof ventilator. A built-in gasoline space heater warms the interior. Two 4-ft. side seats fold down to make a double bed, and there is sleeping space for two other persons in a pinch. The steel body is undercoated and dustproofed, and the roof insulated with Fiberglas<sup>®</sup>.

Counters topped with stainless steel house a gas stove, a 50-lb. icebox, and a sink fed by a 12-gal. water tank. At the back there's a clothes closet on one side, a lavatory on the other. When both doors are opened across the aisle, they enclose an area that serves as a dressing room. Numerous lockers and cabinets can hold small articles. Excluding the large cab and rear "bustle," the body has 360 cubic feet of usable space. A luggage carrier can be mounted on the roof, and a hitch is provided to tow a box trailer or boat.

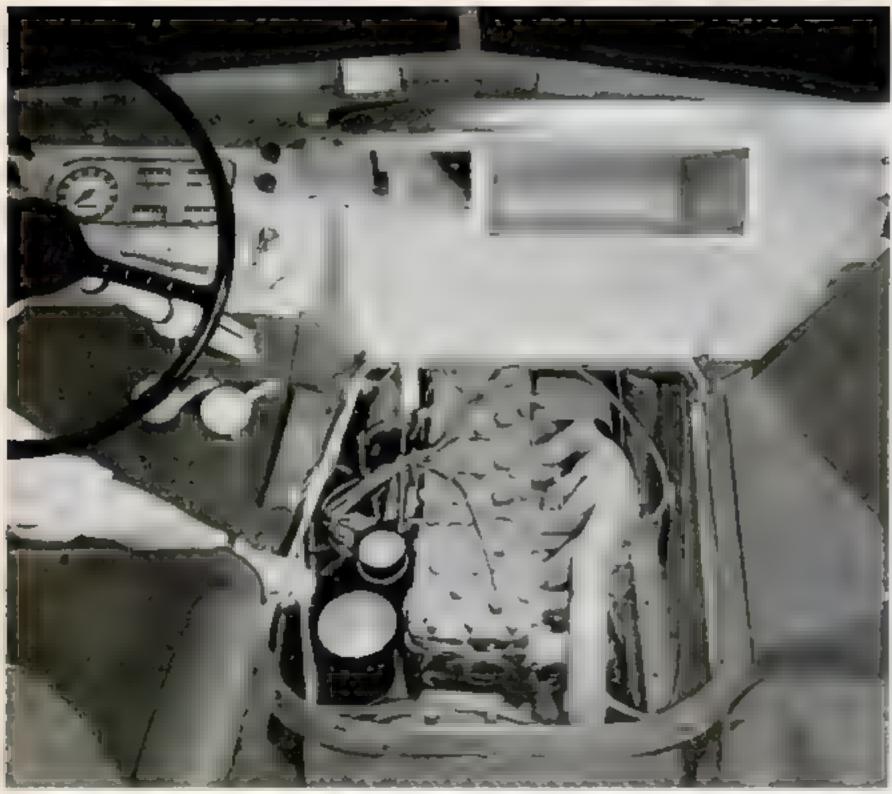
This latter-day Conestoga wagon will probably cost around \$3,000, with optional extras. For users who don't want to lay out that much money, it may be possible to rent them from drive-it-yourself companies for vacations on the high-road.

Rear window hinges upward and locks there. Curved compartments beside door hold butane bottle for stove and emergency water and fuel cans. Spare tire is in lower compartment

"Bustle" hinges downward to make ramp and step for rear door. Chain stops it from touching the ground. Locked horizontally, the bustle becomes a small "back porch."







fafting hinged, insulated cover gaves a cess to 95 large teas nor bord organ. Items

shows be ition of oil dipstick. The map take swings up to let the engine over pass.

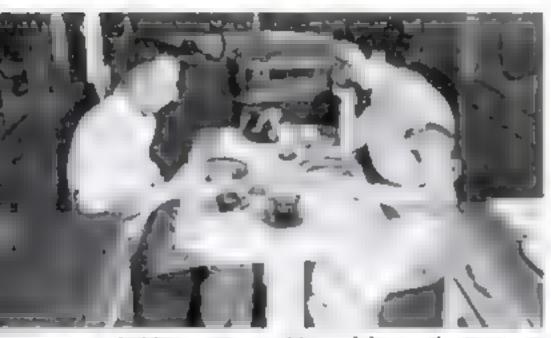


Oversize radiator is reached by sliding front panel out and down over grale. I was vice an motors swing big wipers, the misigne in the center reads 'Ford Bovertown Towning Coach."



Two screw-jacks are pivot-mounted just for ward of rear wheels. Let down when the velucle is parked for the right they keep body from jouncing on its springs. Tires are 7.50 x 17.

Good meals can be cocked on the three-burner gas range with temperature-controlled oven. Exhaust fan is in locker overhead, Icebox, sink, and more storage space are in counter at right



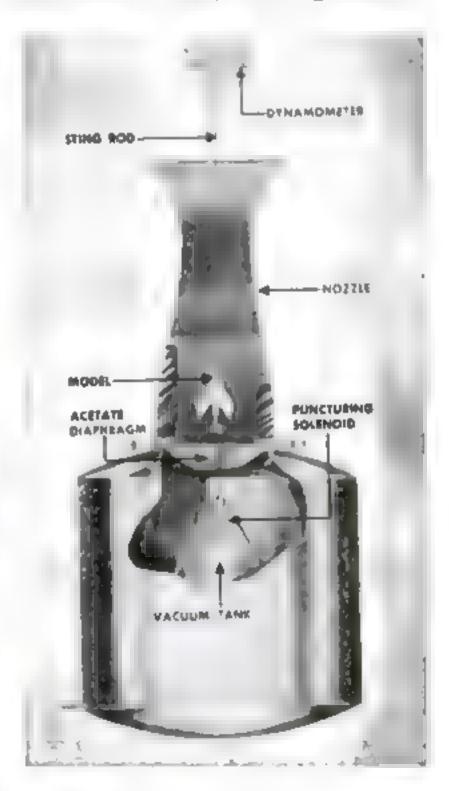
holding center table and long side seats can accommodate four at meals. There's enough headroom inside for a six-footer to stand straight. Table folds flat and can be stowed at one side.



Seat backs bridge aisle to make a comfortable double bed. Rear aisle is big enough to sleep a third adult on an air mattress. A bunk for a child can be fitted at front of the vehicle.

#### Baby Tank Tests Sonic Models

MOST supersome wind tunnels are enormous, expensive pieces of apparatus. But engineers of the National Advisory Committee on Aertmautics have designed a baby model that is comparatively easy on the pocketbook. Its supersome wind is brief, and drag measure-



ments are rough, but that is enough to indicate promising avenues of design.

The tunnel consists mainly of a steel tank five feet in diameter and five feet high. Atop it are a supersonic nozzle and a test section. The test section is separated from the tank by a sheet of acetate plastic. Once a pump has created a vacuum in the tank, this sheet is pierced by an electrically operated punch. The air that then rushes into the vacuum tank creates supersonic flow in the test section.

# How Native Ingenuity Met a Polio Crisis

From grease drams, recusm cleaners, and whittled wooden raires, the mechanics of Mancie, Indiana, improvised their own "from lange."

#### By Stewart Rouse

Photos by Ralph Satterlee

Drawing by Reynold Brown from eye-witness description of scene in Ball Memorial Hospital

O'NE blistering day this past summer the telephone rang loudly in the office of Jack Reichart, an appliance manufacturer in Muncie, Indiana.

"This is Nellie Brown at the hospital," said the voice in the receiver. "You'd better get started on that iron lung we discussed last week. It's an emergency."

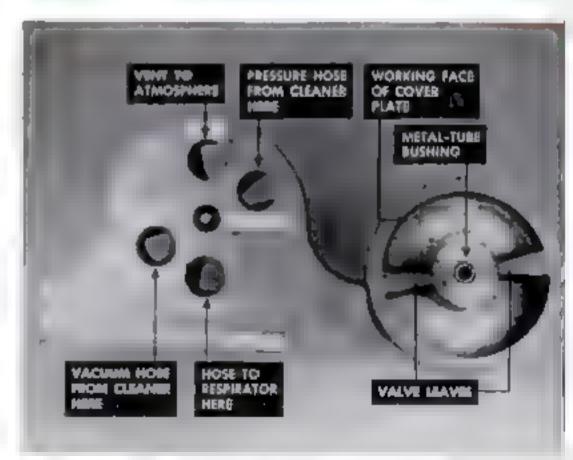
A boy was dying

On the Monday morning that Miss Nellie G. Brown, superintendent of Ball Memonal Hospital, telephoned Reichart, polio (pohomyelitis, or infantile paralysis) was becoming epidemic in the city and in the three-county area around it. Some of the cases were the dread bulbar variety, in which paralysis of the diaphragm muscle finally prevents breathing unless artificial respiration is applied. That meant a need for "iron lungs," the specially constructed cylinders into which air is alternately pumped, then partly exhausted at the normal rate of breathing.

But iron lungs are expensive. Anyway,



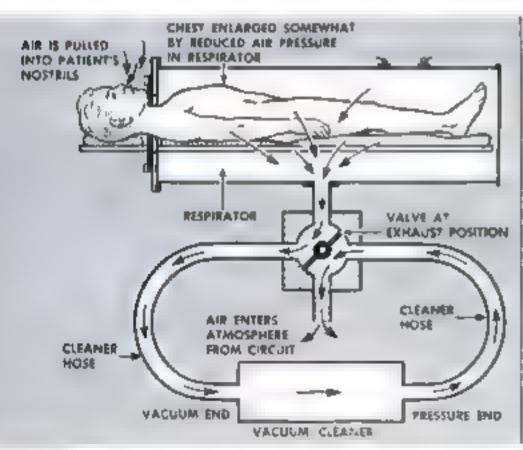
Firemen, working shifts, kept the tired boy



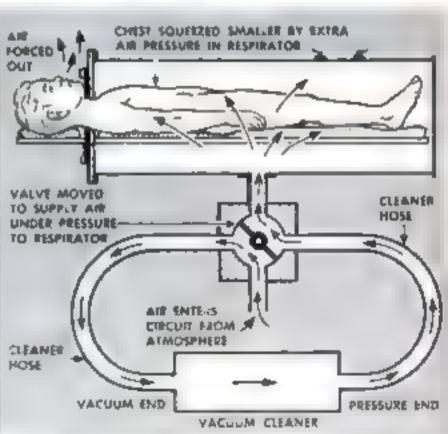
First valves were of hand-carved maliogany. They made it possible to use both ends of vacuum cleaner thus providing positive pressure in chamber to help patient exhale air in his lungs.



breathing-pressing the air out of his chest with their hands-until a valve could be made.



Tank-type vacuum cleaners res or to be be best of the CM not process (2 min relation to the best of the control of the period of the control of the control



During exhalation part of restlicated value of position and a second of the second of

you couldn't buy one that quickly, even with the money. Ball Memorial had three, plus a little portable model. They were already in use. The hospital couldn't wait.

Reichart had a shop accustomed to turn-

ing out unusual jobs.

"Can you make an iron lung?" Miss Brown

had asked hun two days before.

"I don't know," he replied. "I can try."

Over the weekend he had drawn plans
for one of the complicated machines, using
as a guide an article in a medical magazine
several years old Miss Brown had given him.

Now Reichart went to work in his shop. He ripped an end out of each of two big alcohol drums and welded them together. Then he got an ordinary tank-type vacuum cleaner from Sears, Roebuck. He installed a flapper valve in a bung hole on the top of his crude cylinder, and to it attached the hose from the cleaner.

#### 10-Hour "Iron Lung"

He knew he had to control the pulsing of air in and out of the cylinder, so he scrounged around until he found a geared-head electric motor that turned at 3 r p m. On its shaft he put a 10-tooth bicycle sprocket. As the sprocket revolved, a tooth moved a little lever actuating the flapper valve. This permitted the vacuum-creating end of the cleaner to draw air from the cylinder 30 times a minute.

When he was done, he glanced at the clock. The job had taken him just ten hours.

The crude but workable artificial respirator was hurried to the hospital. The boy patient was put in this machine-shop version of an iron lung. When the vacuum cleaner pulled down the atmospheric pressure in the cylinder enclosing his chest, he inhaled by muscular relaxation. The reduced pressure also arched the diaphragm away from the lungs and gave them room to expand. When normal atmospheric pressure flowed back into the respirator, 30 times each minute, the boy exhaled.

Local resourcefulness had won the first round. But the crisis with the patient was not over. It had only been postponed.

A few hours later another emergency developed. The boy's chest muscles began to tire. Atmospheric pressure alone was not enough to produce the sharp exhalation needed to keep pumping a supply of oxygen to his system. Doctors gathered around. At the rate the patient was tiring, he had no more than four hours to live.

Something had to be done to supply positive pressure outside his chest cavity to force the air out after each inhalation.

The vacuum cleaner was taking part of the air out of the cylinder, but it wasn't forcing any back. Its blower was just venting positive air pressure into the room.

There was the problem: to make some sort of a compound valve with ports that could use, in correct sequence, both the negative and positive pressures already available. Moreover, it had to permit a choice in operating speeds. Human beings of different ages breathe at different rates.

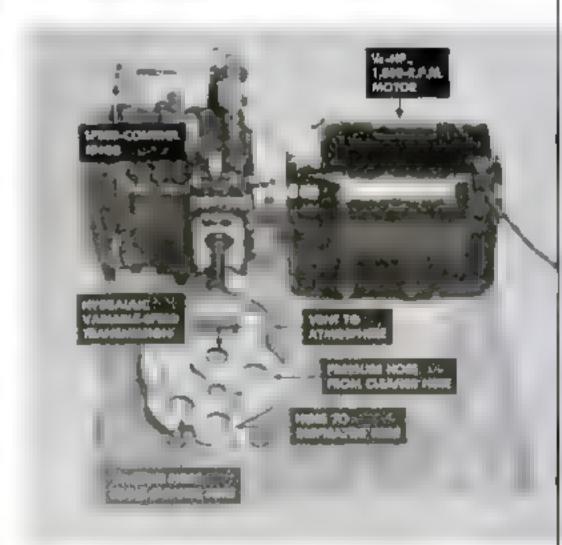
Here the Borg-Warner Corp. stepped in. This firm's Warner Gear Division has no mean talents. Readers of Popular Science know it as the home of the automobile over-drive (PS, Apr. '49, p. 180).

A Warner engineer started to work on that valve. Meantime, volunteer firemen, with their arms stuck through access holes in the respirator, applied hand pressure to the child's chest to aid each exhalation.

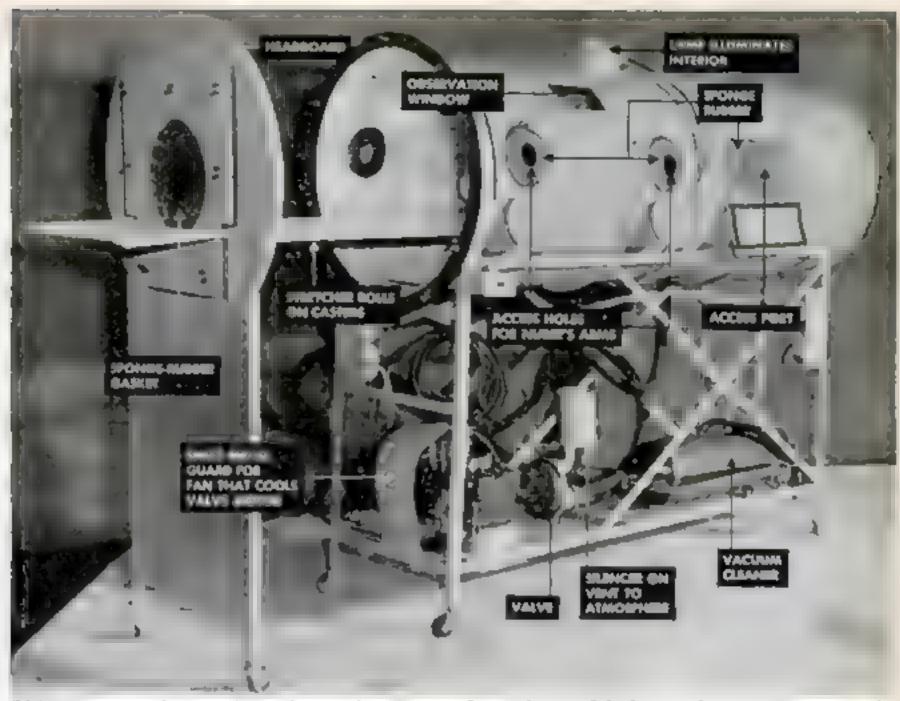
The engineer telephoned two skilled pattern makers.

"Get ready to do some fast whittling," he said. "We're trying to save a life."

In just 90 minutes the engineer had drawn up a design for the valve. The pattern makers whittled. The wood over which their

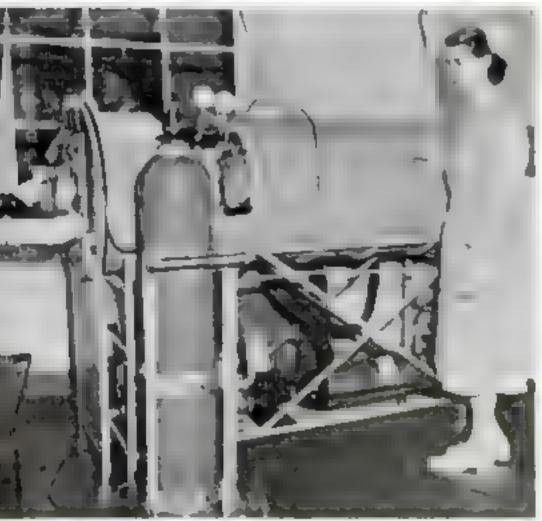


This is a close-up of the motor-driven controlvalve unit. In time, aluminum casting replaced handmade wooden valve. Valve allows an inhalation time twice as long as the exhalation period.



This is a general view of "production has from hing local angement's answer to the Muncie tracky tay Headward spatial away to a care

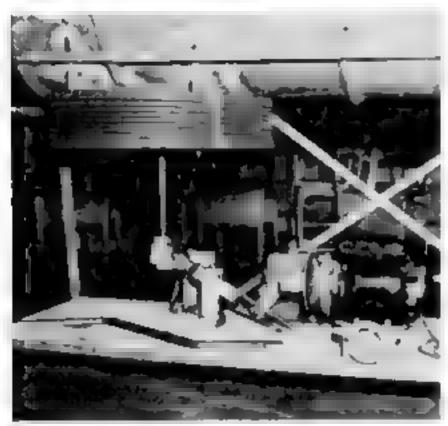
ber. The model shown above incorporates the latest improvements, including a fan to cool the electric motor that turns breathing-cycle take



On duty in hospital, machine shops' iron lung is supplemented with oxygen apparatus for patient in critical condition. Cleaner and valve assembly are mainted on plywood shocks



In case of breakdown of cleaner unit, pertable emergency unit is provided. It can be plumed in instintly to restart respirator. Connections are regular lasse, ferrale fittings.



Warner Gear produced another type of iron lung in which single bellows both pressurizes and evacuates cylinder. Bellows is 24 m. in diameter, 10 in. long extended, 6 in. collapsed.

hands flew was mahogany. It was tough going—mahogany is hard. But in just four hours a two-piece wooden rotary valve had been fushioned and installed in Reichart's emergency iron lung. For the next ten hours it was hand-operated by one of the volunteer firemen.

The child patient, his weary chest muscles relieved of the task of expelling the air from his lungs, was breathing at a normal rate.

But in the Warner workshop one thing remained to be done. A motor drive had to be devised for that valve. The engineer went back to his bench. Several war-surplus, variable-speed hydraulic transmissions—the kind that revolve power turrets on bombers—were lying around

To the input shaft of one of these transmissions he connected a %-h p. electric motor turning at 1,800 r.p.m. On the output shaft he put a steel yoke to turn the valve cover plate of the iron lung's wooden valve at any desired speed. By twisting a knob on the transmission, the respiration rate of the lung could be set to any speed from 15 to 38 breaths a minute.

The valve motor drive was installed. The youngster in the lung was given a new, if momentary, lease on life.

Now that they had proved it could be done, both Warner Gear and Reichart proceeded to make mechanical respirators as fast as they could to meet the challenge of the epidemic. Other wooden valves were turned out. Other power turnet transmis-

sions were found in the area. Sears continued to supply vacuum cleaners without charge. Many other retail stores, supply houses, and manufacturers joined in donating much-needed materials and services.

Presently the wooden valves were replaced by metal ones using a steel rotating cover plate and a stationary aluminum port plate. Castings for these, requiring a minimum of machining, were produced at a Muncie foundry. For "production-line" respirators, two 55-gallon steel grease drums were substituted for the alcohol drums. The grease drums required less work. They had removable lids.

Failure of a vacuum cleaner had to be thought of. What would happen if one of the units got out of order? So Warner began supplying a portable valve unit, valve drive, and vacuum cleaner, ready to plug into a respirator if anything went wrong.

#### New Respirator Devised

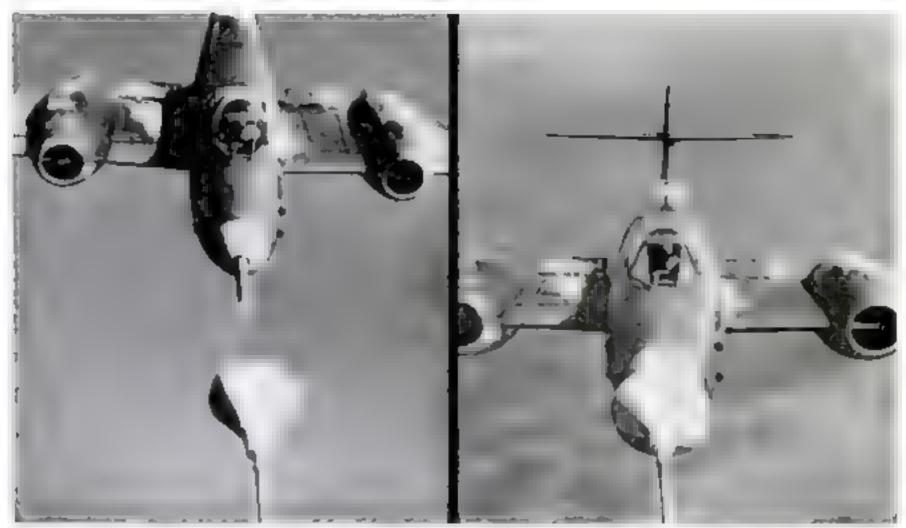
Not content with that, Warner designed and sent a new type of respirator to the hospital to be put to work. This one was bellows-operated. A concertina-like bellows made by a Muncie organ company provided both the vacuum and pressure phases of the operating cycle. A single pipe connected it to the respirator. When the bellows was extended, it caused a partial vacuum within the lung. When it was collapsed, it built up pressure in the lung. No valves were required except the relief valves to control the amount of vacuum and pressure.

It would be good to close the story of the emergency iron lungs with the news that the young patient who inspired the work, Rue Steele, son of a Muncie truck driver, recovered from his polio attack. We can't. The paralysis induced by the disease eventually proved too much for his 10-year-old body to combat.

But he left a legacy—a growing row of aron lungs created by native inventiveness, produced by a couple of Midwestern machine shops, in the American tradition of ingenuity and self-help. And because of this, several other children and adults are alive today in Muncie, Indiana.

#### Tractor Carries Rescue Gear

A LICHT tractor developed in England has a power winch and 100 yards of cable mounted in front to pull itself across a field if the going gets too tough when plowing a deep furrow.



Meteor jet fighter approaches funnel-tipped refueling line to replenish tanks in experiment.

Contact is made. Note perforated dive brakes used to slow plane's speed, maintain altitude.

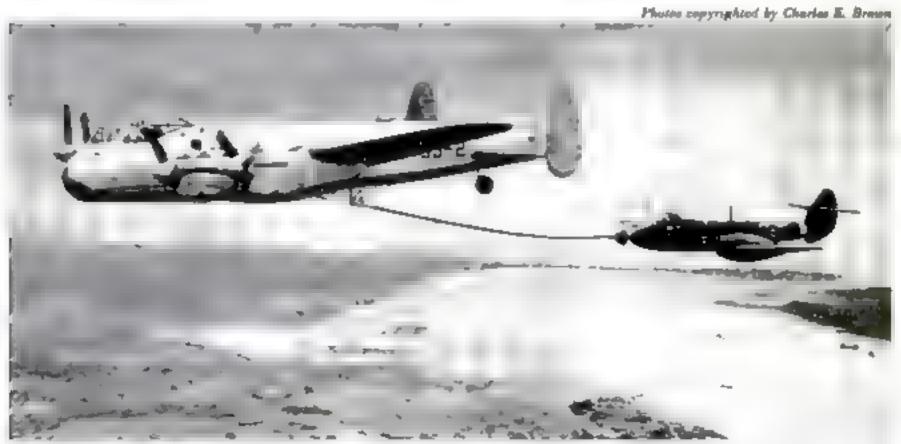
#### Jet Refuels Like Humming Bird

STICKING its nose into a refueling funnel in mid-air as a humming bird would explore a flower, this British jet fighter was able to stay aloft for twelve hours. With a normal flight duration of only 90 minutes, it had to take on fuel ten times.

In this new type of refueling, in which the

Meteor, Britain's fastest jet, was used, the objective was to determine whether the range of such aircraft could be increased. Incidental to the experiment was the setting of what is believed to be a new world's record for jet-flight duration. A propellered plane was used as a tanker. A total of 3,000 gallons of kerosene was transferred.

Once contact was made, the tanker proceeded to pump fuel rearward to the jet. Britain, a pioneer in mid-air refueling, started experiments before the war.



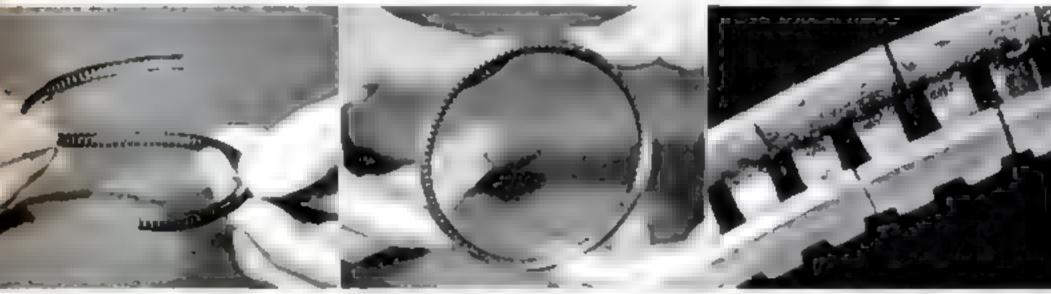
Here is a side view of refueling operation as jet noses into cone slightly below tanker's level.

# 1950 Nash Boasts Longer-

AN ENGINE reported to run 50 percent longer between major overhauls is the big feature of the 1950 Nash, unveiled late last month. The secret lies in just one change—a new type of piston ring that always keeps the right amount of oil flowing

to the cylinder walls. It does this even when the cylinder is worn or out-of-round, say Nash engineers.

While keeping the same general styling, Nash has increased window area and sheked up the interior. Some models have a back-



Key to expected longer engine life for the new Nash is Seal-Flex® oil control ring, developed by Thompson Products. Lowest of four rings on piston, its oil-wiping surface is formed

by U-shaped sections placed end to end Tiny slots, 001" wide, channel oil to upper cylinder walls. Tests show wear has little effect on the size of slots, maintaining good oil economy.



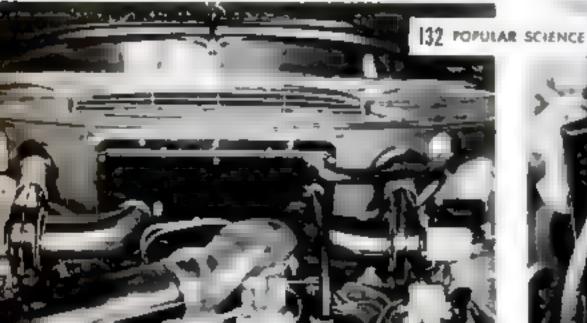
Sliding bin replaces drop-door glove compartment. Maps, knickknacks can't fail out. Roll-top sliding panel covers radio, secondary driving controls. One lock secures bin and panel.

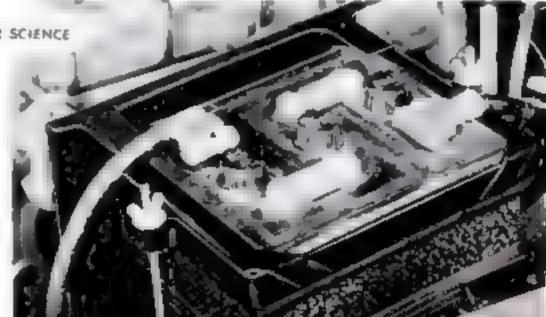
Nash's Weather Eye air conditioner is improved. Defroster effectiveness is increased by dual blowers and motors, one for each side of windshield. One knob replaces two on heater.



Basic controls are grouped at left of steering column where they're easy to reach. Hydra-Matic is now optional in Ambassadors; when used, engine is started by lifting selector lever.

Metal shield now protects battery from engine heat on hot days. Ambassador has vertical tube radiator, replacing cross-flow type. Hand-brake cable is fully enclosed in housing.



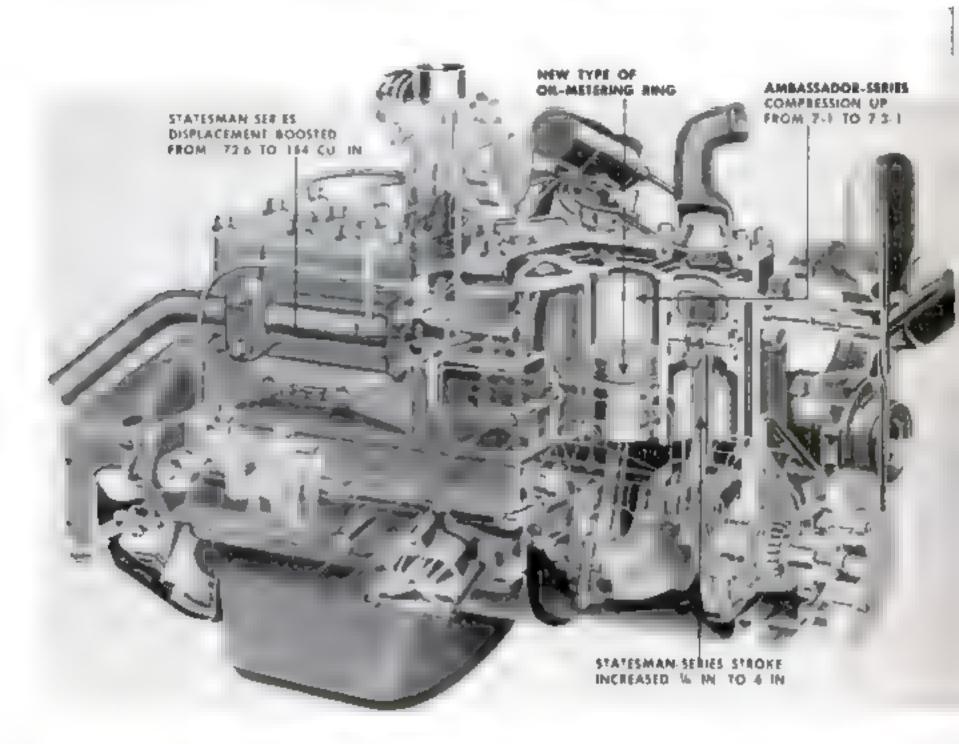


# Lasting Engine

seat armrest big enough to play gin rummy on and a front seat adjustable to any angle.

In the Ambassadors the compression ratio has been boosted. In the Statesmanwhich replaces the "600" series-the stroke is longer and the displacement bigger, END



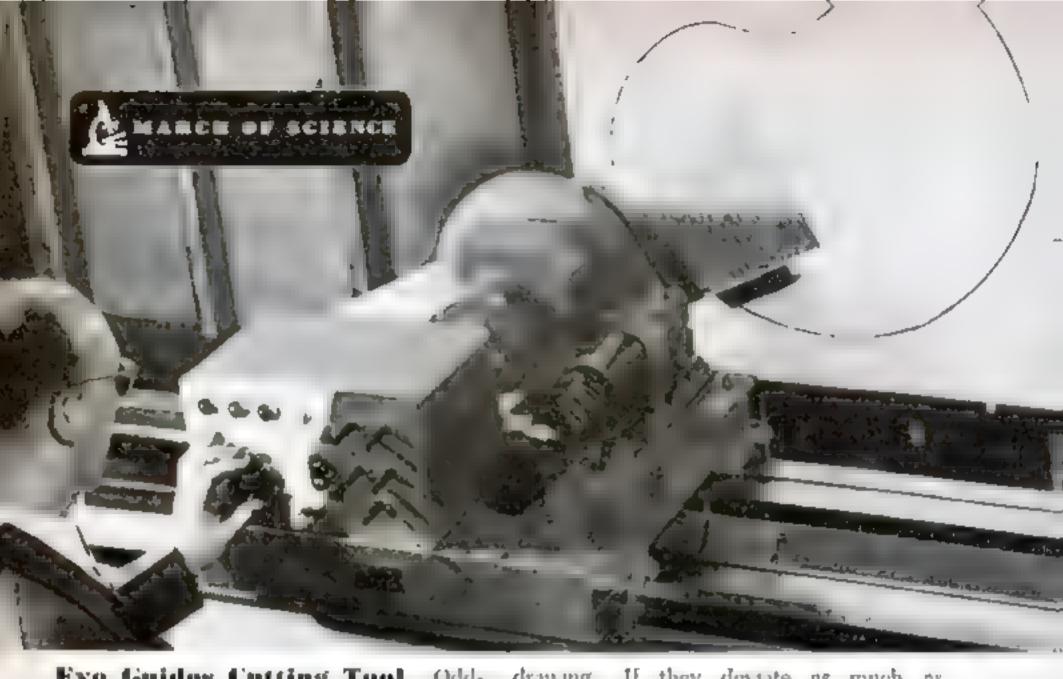


New engines feature improved cylinder heads, harder valve stems, and better lubrication.

Right front seat has feature motorists have forms one of twin beds that have long been been wanting for years. It is airplane-type, can be adjusted to three intermediate positions plus upright and horizontal. Fully rectined, seat

Nash accessory. Available as extra-cost, optional equipment on all models it can be made up and used as a separate bed while car is moving

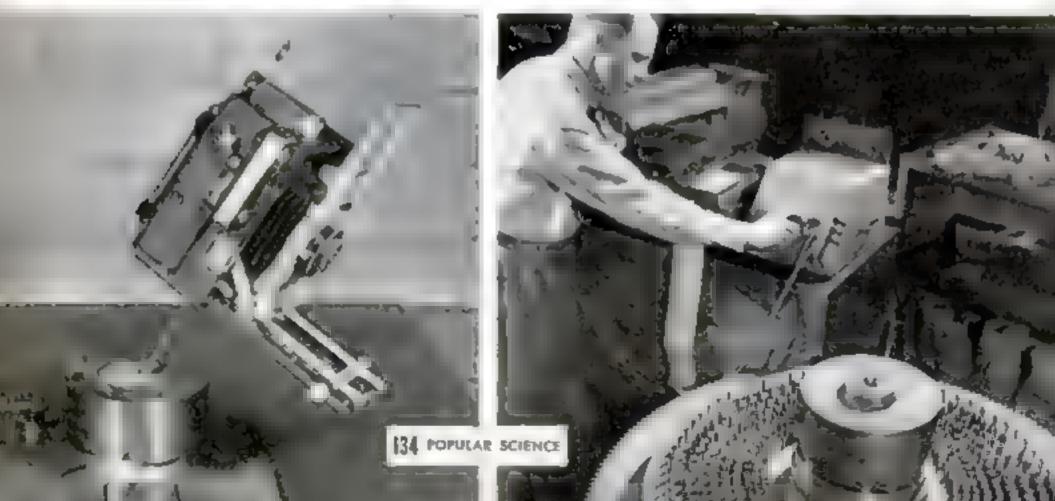




Eye Guides Cutting Tool. Oddshaped pieces of not d can be cut out automatically with the help of GL's electronic contona follower? There A in croscope and photocectic (cl) nose doi: an outline drawing. If they deviate as much as 3 1 000 inch from the path, an electronae signal himgs them back. Controls order a pobling in where to move in exact synchronism, cutting the shape in metal,

Magnetism Holds Camera. Item off a switch and you can filt the camera below to any angle. Turn it on and the camera mount freezes. The tricky "pan head," a Bureau of Stard rest diptation of its magnetic clutch. PS June 15 p. \$37, consists of a net 1 bidl it a socket centiming oil and from file as When magnetized by an electron gret. Call each sold fies

Machines Free. Too. In big thrust bearings, the mating parts shift less than a imbiguith of an inch, but that is enough to cause mechanical and chemical action that cits away the metal. Westinghouse cogneers use the model below to find ways of stopping this 'fret corros on'. "Proes sticking up are spring loaded screws that can very pressure between parts."



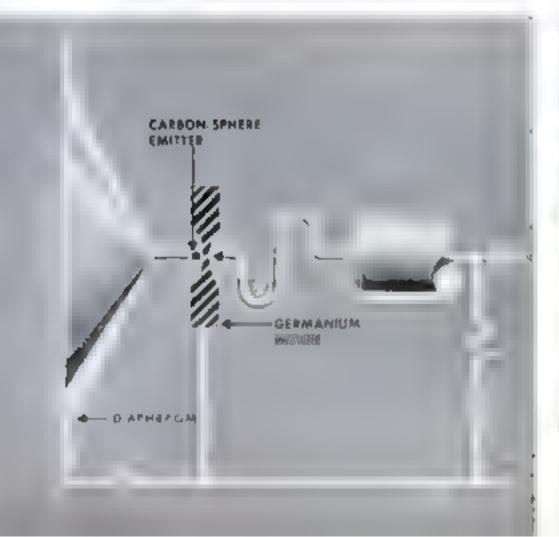


Study Trapped Light. It looks like Dr. Danal Alpert has bottled up serie light in the seriest uncorrected it skeat right above. Actually, the trisk contains sociality yapor, which radiates light of its own when

struck by intraviolet light from the proicctor a lett. By stucying sect pli no nena Westinghouse R sea ch Laborate as Ecpes to improve their secret for 8 and periops discover new light sources.

New Mike at Last? Edson invented the earbon telephone trasmatic 72 vers good at its stall used to be trasmatic 72 vers good at its stall used to be trasmatic united by the Boundards scientists have produced a new kind on ploying the Doms stort. Ph. Supt. Ph. p. 117—that has semeday replace it. When the diaphrigh valuates, it moves the Domsisters condition see sketch) virying the current

Haking Preserves Crystals. The quartz crystals that keep rada television, and radar equalment in tune are now being baked in excess to make them stay young. Ordinarily the crystals change their characteristics with age, causing their frequency to dot. The new leaf treatment developed by physicists of the Army Signal Corps in akes them last indefinitely.







Radio taps the keys as seven-ship flying typewriter prints 15-mile-long placards at 10,000 feet.

#### By Herbert Johannen

WRITERS in the sky have abandoned old-fashtoned, one-plane "penmanship." Now they're "typing" out their aerial messages in neat block letters

The "keys" of Skytyping are seven planes that fly a straight, parallel course across the sky. Electronic controls puff smoke at presclected intervals to form celestial letters as in the word "TEST," shown in the photo at the top of this page

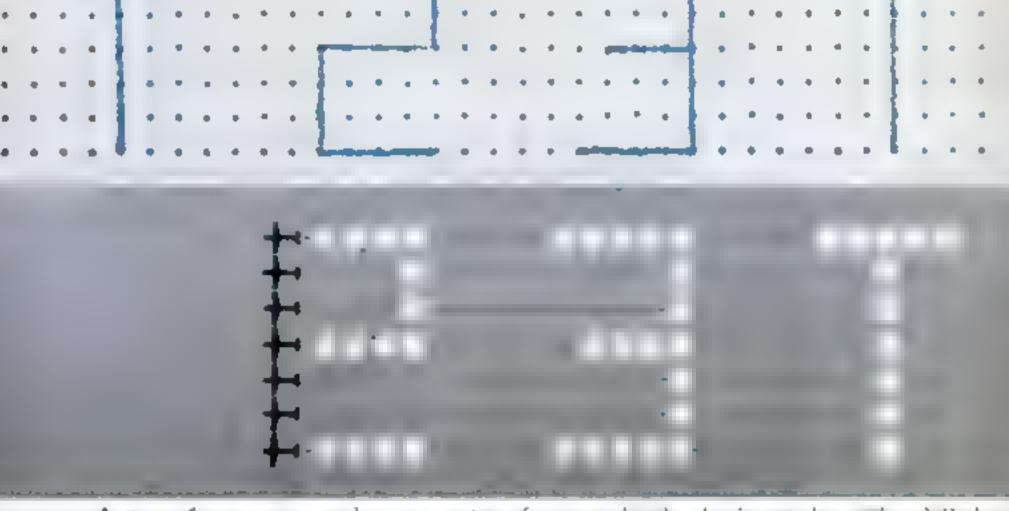
A "mother" plane, flying in the center of the formation, automatically controls the entire operation. It transmits a constant stream of radio tone signals at one-second intervals. As receiving sets in each of the seven planes, including the mother plane, pick up the signals, switches are thrown in a control board that has 200 plug-in sockets. The board in each plane has been preset ac-

When a puff of smoke is desired to form part of a letter, a plug-in closes an electronic circuit. That, in turn, opens a special valve in the engine, releasing a small quantity of oil-base chemical into the exhaust pipe. Heat of the engine expands the chemical into smoke at a rate of 1,000,000 cubic feet a minute. The result is a huge, 375,000-cubic-foot smoke puff left in the sky. Where no puff is desired, there is no plug-in on the control board, and the switch activated by the mother plane's radio tone clicks a blank

Skytyping, a patented process, is the brain child of S. S. Pike, head of The Skywriting Corporation, New York. Since it requires fast planes of equal performance, he only dreamed of his sky-printing process for many years until war-surplus AT-6 Air Force trainers became available. Then he went to work with electronic engineers to develop the complex radio equipment that could belch an educated aerial alphabet.

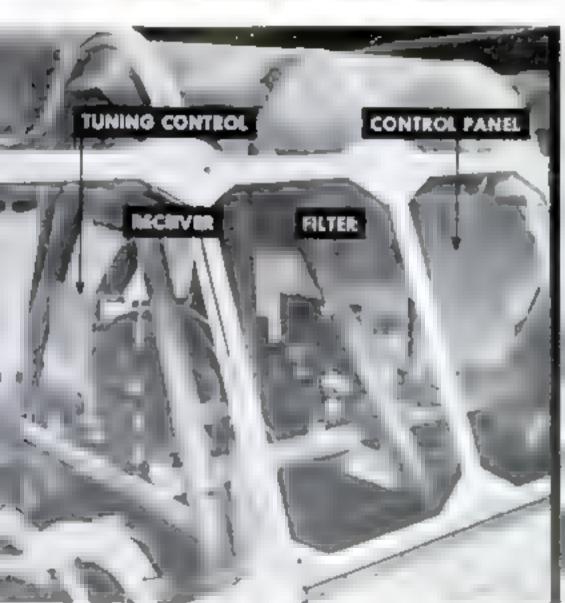
#### Early Experiments Produced Queer Results

Metropolitan New York saw the first samples of the flying typewriter at work. And early experiments left many citizens with cricks in their necks and puzzles in their minds. Failures of the electronic relays played some queer tricks. A puff skipped here and there, and a message would resemble something written in Arabic or Chinese. And more than once the Skytyping pilots, all war veterans, feared they might have been putt-puffing highly censorable phrases.



Letters of a message are drawn on a strip of paper using seven rows. I minibined dots then it will represent the flight path of the plan. Where lakes cross does, corresponding place inc.

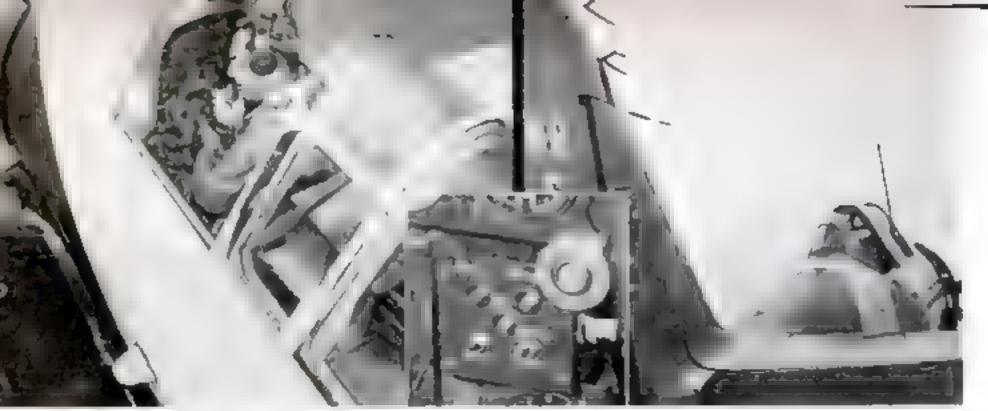
inserted in the plane's control switchboard. Undays let predict social series are control single pulls of social to team to sky letters. Written backwards to young permissional real grand.



Rear seat to All and the seat of the seat



where this plane will puff smoke to form its



Chief pilot in the mother plane gives the goahead over veice transmitter when the planes are fined up. Inset shows his switch panel that controls the operation. Switch at lower left,

flipped when a light indicates the end of a message, resets the electronic relays for another run. Photo at right shows the special transmitting antennas of the control plane.

But that's all straightened out now, according to Mr. Pike. His spelling planes do a smooth job. Flying at about 180 m.p.h., a team of seven AT-6s can print a 21-letter, 15-mile-long message across the sky in five minutes. Each letter, approximately a mile long and half a mile wide, is made in 10 seconds flat

The messages, or slogans, are written at altitudes of from 10,000 to 15,000 feet, depending on air turbulence. Pike says that on clear days his Skytyping can be read 40 miles away, with the letters remaining intact as long as half an hour.

In the old, one-plane skywriting, the first letter of a word is often gone with the

wind before the last letter is formed. It also involves complicated flying maneuvers, with hazardous loops, rolls, and dives needed to form the characters.

In Skytyping, on the other hand, the pilots simply fly a straight line. Everything also is automatic from the word "Start," called out by the pilot of the middle mother plane over his voice radio.

When the full message has been spelled out, as preset in the switchboards, a light signals "End" and the control pilot orders everyone to flip a "Reset" switch that zeroes the electronic relays, readying the planes' smoke-puffing apparatus for another spelling run across the sky.



Guide bars on wingtip at left above help the pilots to line up with the mother plane in flight and to maintain an interval of 400 feet between planes. Simplified switch box shown in inset

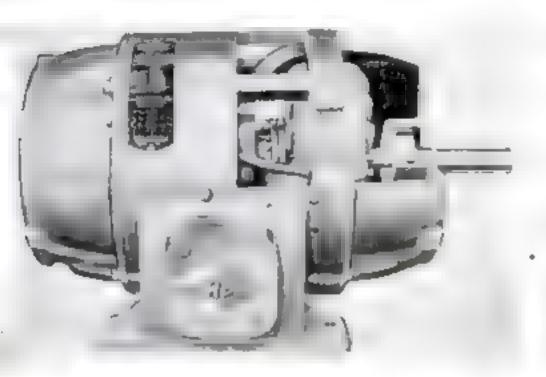
has only reset switch. Lights on top indicate that message has started and that smoke puffer is working. Photo above right shows a smoke puff leaving engine exhaust of plane on ground.



#### Station Wagon Has Jeep Drive

THE war-famous jeep now comes in a station-wagon model that has the same selective 2- and 4-wheel drive the jeep used during the war. Loaded to its half-ton

capacity, the car can climb a 59-percent grade. Willys-Overland, the manufacturer, says it can travel off the road through mud, snow, or sand that would bog down ordinary vehicles. It has a 104%-in, wheelbase, comes with either right- or left-hand drive.



#### Motor Gets Fluid Drive Shaft

THE new electric motor at left is the first of its type to feature a fluid coupling built right into its drive shaft. Designed to permit easier starting under heavy loads and to prevent jamming, the combination motor and oil drive is said to occupy about the same space as a motor alone and to cost less than two separate units. Among its applications are conveyers, extractors, and bridge and trolley drives for cranes and mixers. Made by the Reuland Electric Co., of Alhambra, Calif., the Fluid-Shaft<sup>®</sup> motors range from % to 10 hp.

#### **Dropped Rocket Boosts New Navy Missile**

ONE of the newest wrinkles in guidedmissile research is the Navy's Lark, launched from aboard ship. Officially designated the XSAM-N-4, it is powered primarily by a high-thrust, liquid-fuel rocket motor, but as it is launched (below, left), added boost is supplied by a jettisonable twin rocket. This is shown dropping away from the missile at right. Made for the Navy's Bureau of Aeronautics at the San Diego plant of the Consolidated Vultee Aircraft Corp., the new missile is designed to intercept enemy planes.







## Rare Metals, Once Forgotten, Now in Production

Metals of atomic age may have names like prascodymium, thanks to new process for purifying rare earths.

#### By Alden P. Armagnac

SPANG in the middle of Iowa there's something nearly as tall as the cornand more exciting. It's a bank of glass tubes. Out of them come strange metals, some of the most precious on earth, whose unusual properties may prove vital to the atomic age.

They once were rarer than diamonds and actually priceless. Even now, being produced in pound lots by a method born of the atom-bomb project, they cost up to 31 times their weight in gold.

Few people have ever seen them. Gray to light gray with high metallic luster at



Worth 31 times its weight in gold, silvery praseodymmin metal in vial at left is sealed from our which turns it black. One source of rare-earth metals is monazite sand, above.

A POPULAR SCIENCE

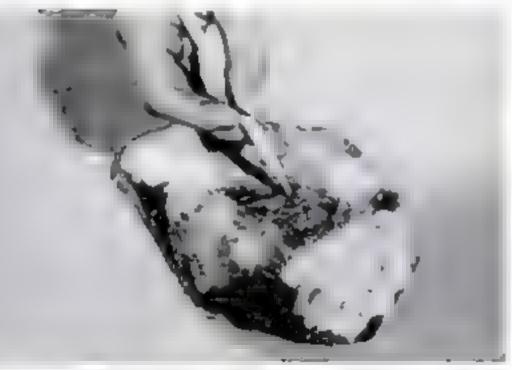
first, they turn odd shades on exposure to air—pale yellow, cream color, black, grayish pink. Their compounds vie in brilliant hues with the colors of the rainbow.

Called the "rare-earth" metals, they are true chemical elements, just as iron, copper, and silver are. Their names sound like something out of an apothecary shop-lanthanum, cerium, praseodymium, neodymium, to mention a few.

Small wonder if the names are new to you. For the whole group of 15 rare-earth metals, listed on page 143, might well be called the "forgotten elements." They make up nearly one-sixth of the 96 known elements, the basic materials of which all things are made. Yet a typical college textbook on chemistry, more than 1,000 pages long, devotes a scant two pages to them.

Practical uses have been as few in proportion. Just one may be familiar to most laymen. Spin the wheel of your cigarette lighter, and you are striking fire from pyrophoric, or spark-producing, rare earths, cerium metal in particular, in the alloy of the fint. Lanthanum oxide goes into special optical glass for aerial-camera lenses. Neodymium oxide absorbs glare in glass-blowers' goggles. Carbon-are projectors in movie theaters give an intense white light because of rare earths in the carbons. There have been a few other uses for rare earths, but not many.

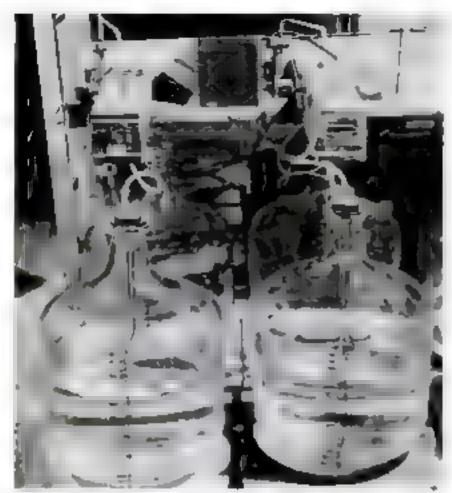
Today, however, these forgotten elements have become news. Atomic research has focused the spotlight upon them. And under the direction of Dr. Frank H. Spedding,



Glossy black portion of gadobute ore, pointed out above, also yields many rare-earth elements. Ore and one of metals, gadobution are named after Finnish rare-earth chemist Gadoan,



Dozens of these eight foot-tall ion-exchange columns, at Ames, Iowa, "rehiery," are inplish feat of separating rare-earth elements, which are almost identical chemically



Ingenious control automatically switches output of column from full to empty collecting bottle. Rising liquid trips electric circuit, shifting carriage holding funnels and delivery tubes.

Iowa State College chemist, the Ames Laboratory of the U. S. Atomic Energy Commission has begun producing highly purified rare-earth metals and compounds in unprecedented quantity.

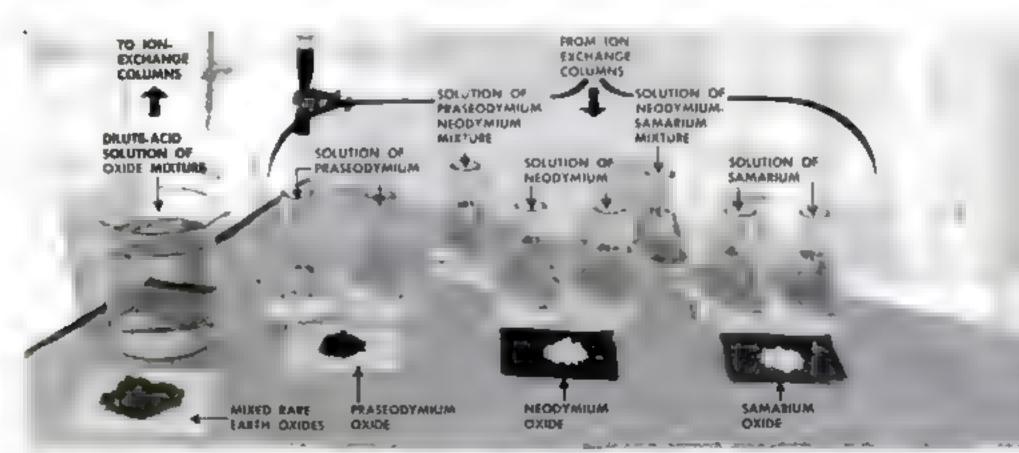
One object is to see if they may be useful materials for future atomic power plants—for instance, in control rods and in lightweight shielding against dangerous radiation from atomic engines of ships and

planes. Forming as "ashes" in uranium rods of piles, rare earths have been a nuisance, tending to put out the atomic fires by absorbing neutrons. But that very vice would be a virtue in shielding and control

"Moreover," says the U. S. Atomic Energy Commission, "it now appears that they may have a bright commercial future as alloy metals in the manufacture of high-temperature structural materials."

It's partly the small proportion of rare earths in the earth's crust-there's as much gold in sea water-that makes them "rare," not scarcity of places where they can be found. One widely distributed ore is the yellow-to-brown monazite sand of the Carolinas, Brazil, Africa, and India. Norwegian mines furnish gadolimite, a glossy black rare-earth ore, and others, Rare earths of commerce have been relatively inexpensive "concentrates" or crude mixtures obtained from these ores. For example, cerium for cigarette-lighter flints is a \$4-a-pound commercial alloy known as "mischmetal," consisting of cerium and seven other rare-earth metals, and other impurities.

But one of the biggest reasons the rare earths are so "rare" is their unusual chemical resemblance to each other. They are so much alike that ordinary chemical methods cannot separate one from the others. Years of tedious evaporating and redissolving were formerly necessary to get a few specks of material.



Pictorial diagram shows separation process at a glance. Rare-earth oxide mixture, dissolved in acid (in beaker) goes into columns. Rinsing with citric acid and ammonium citrate yields

series of "fractions" in flasks, of which last obtained is beneath delivery tube. From pure fractions, oxalic acid precipitates oxalates, converted by heat to pure oxides shown.

Then in early 1944, workers on the atombomb project, including those at Ames, Iowa, made the amazing discovery that rare earths formed by uranium fission could be separated—in hours instead of years—simply by passing a solution of them through a vertical tubeful of synthetic resin. Samples were, at first, sub-visible "tracer" quantities; later, visible ones of ten-thousandths of an ounce.

Exciting news came from Clinton Laboratories at Oak Ridge, Tenn., when two young chemists separated a mysterious substance from fission-produced neodymium with one of the new resin tubes or "ion-exchange columns." It proved to be the long-missing rare-earth element No. 61, which they named prometheum. Radio-active and shortlived, it is believed non-existent in nature. First visible samples, pink and yellow smears on white porcelain disks, are minute quantities of prometheum nitrate and chloride respectively.

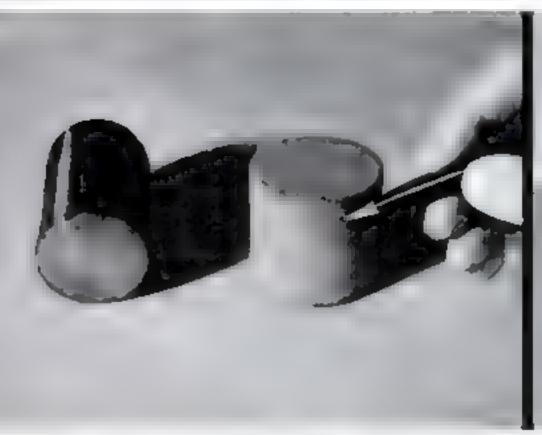
In the meantime, Dr. Spedding of Iowa State proposed as bold a step-up in scale as that from a pinhead of plutonium to pounds of it for the bomb. Instead of being content with "micro" quantities of pure rare earths, why not adapt the new method to produce them in "macro" amounts of grams or even pounds? He and his colleagues installed a battery of 24 resin columns, eight feet tall and four inches in diameter—and made history by accomplishing the feat.

Watching the precious liquids trickle

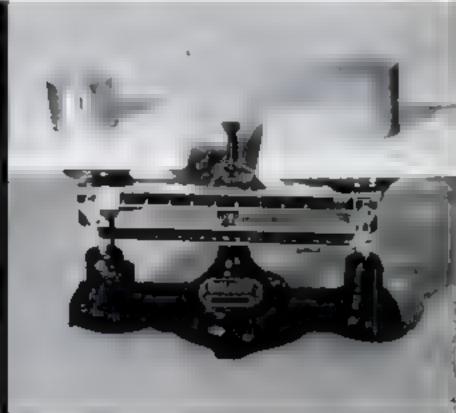
		"Forgotten Rare-Earth	
NAME (with		CHEMICAL	ELEMENT

Known as in	e nare-rorin	METRI
NAME (with source or meaning)	CHEMICAL SYMBOL	ELEMENT NO.:
LANTHANUM "To lie hidden"—Gi	Les resk.	87
CERIUM. Ceros, a planesoid,	Ce	30
"Gram" (from order	Pr of sales), "toois"—i	59 Grank,
"New," "twin"—Ge	Mell well,	40
Prometheum mythios	Pro- Lifer-green.	61
SAMARIUM Somerski, a Rumian	Sen mine official,	42
EUROPIUM, Europa,	Su .	43
GADOLINIUM Gadelin, Finalsh chi	phot.	44
TERRIUM Yearby, in Sweden,	The course of rose-earth s	45 ve,
DYSPROSIUM "Herd to get of"—0	Dy Fresk,	44
HOLMIUM Holmin, Latin name	for Stackhalm,	47
ERBIUM Yanniy—am alone,	Br	68
THULSUM Thuic, or "Northian	A" Ten	69
Ytteraium Ytterby—sm aisecs,	Yh	70
Lutecium Luicia, Latin name	for ancient Paris,	71

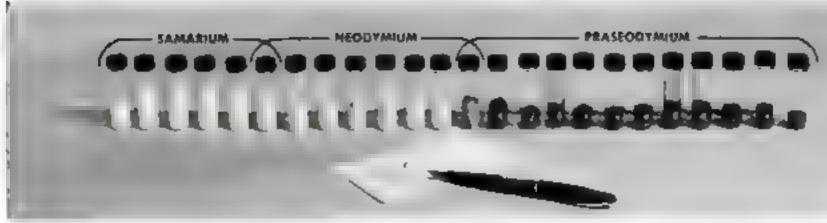
from glistening glass columns into collecting bottles the size of eider jugs, a visitor to this pilot plant hurdly realizes the naraele taking place in the tubes



Air gives cerum, right, this cream-colored coating. Freshly machined lanthanum, left, shines like steel. Each sample of rarely seen metal weighs 1.3 lb, and is valued at \$1,200.



Rare-earth metals are only moderately heavy. Cerum on right-hand side of scales, with density 6.8 times that of water, is balanced by smaller piece of copper with density of 8.9.



Yields of rure earths in oxide form, from series of 12-hour runs through columns, show almost

total separation of test mixture of equal-parts of samarium, neodymium, and praseodymium.

Into the top of a tube goes a hodgepodge of rare-earth elements-redissolved in acid after acid extraction from the ore and crude preliminary chemical separation into two.

main groups, light and heavy.

Like flies to flypaper, ions—individual charged atoms-of rare earths stick to the resin at the upper end of the tube. Thus they are strained—"adsorbed" is the technical word-from the acid, which is then removed by washing.

#### Down Go the long

Now a dilute solution of citric acid and ammonium citrate is poured down the column. Rinsed from the resin, or "eluted" if you prefer the scientific term, a typical rare-earth ion starts down the tube. Almost at once it sticks to the resm again. This skip-stop progress repeats itself, over and over, all the way to the tube's bottom.

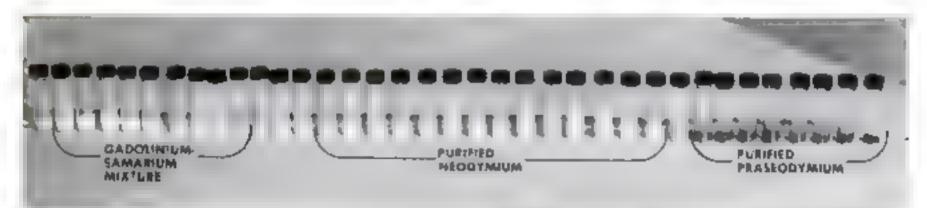
Eventually all the rare-earth particles reach bottom. But those of the element of highest atomic number get there first; those of the next highest number, next, and so on. Switch the liquid output from one collecting bottle to another, at the right time intervals, and nearly every bottleful or "fraction" will contain a single purified rare-earth element. A few fractions in which elements overlap are re-treated; and purified fractions, if still higher purity is wanted, may also be run through a column again.

The solutions yield oxalates, by precipi-

tation with exalic acid. Then heat treatment converts these to the rare-earth oxides—the form desired for many experiments and from which other compounds may readily be prepared. Purity runs around 99.9 percent.

By "smelting" rare-earth oxides when enough are on hand, the Ames workers produce miniature ingots of the pure metalstiny 1/20-oz, cylinders of silvery praseodymium and neodymium metals, sealed against corroding air in helium-filled glass vials, and comparatively massive 1.3-lb, chunks of cerium and lanthanum metals. Their weight compares with fron, their softness with calcrum; like the latter, they react with water, liberating hydrogen. Producing one avoirdupois ounce of praseodymium costs almost \$1,000; of neodymium, \$170; of lanthanum and cerium, \$57 each—compared with the value of an ounce of pure gold (\$35 per froy ounce).

If new uses require pure metals, even these prices—which the experimenters hope to reduce-may not be commercially prohibitive. Like radium in watch dials, a little may go a long way. Or like platinum in chemical crucibles, advantages may outweigh cost. But it is primarily for research that scientists prize the newly available pure preparations. At last their long-mysterious properties can be fully explored for possible exploitation. The "forgotten elements" are forgotten no longer.



Results of another test show successful recovery of neodymium and prascodymium from complicated mixture of other rare earths including hard-to-separate gadolinium and samarnim.



### Atom Barrage Cleans Metals

ATOMS have found a new use in industry they're being shot at pieces of metal, like peas from a blowpipe, to clean off the top surface. Following this treatment, called cathodic vacuum etching, microscopic exammation reveals lines showing how the metal The new process, developed by the Ford Motor Co., works like this: A metal sample is placed in a vacuum, above, with some

argon (the gas used to fill light builts). A potential of 12,000 volts shoots charged argon atoms down at the metal sample, and the speeding atoms etch the surface.



### Tiny Counter Finds Uranium

If you hold this midget Geiger counter next to a radium-covered watch dial (left), it will make your earphones click and a neon bulb flash. It will do the same over uranium deposits—and that might mean a \$10,000 Government bonus for the lucky prospector

Powered by standard, easily replaced radio batteries, the counter weighs only two pounds and measures 2% by 4% by 5% inches. It indicates the activity of ores by the speed of the clicks and flashes.

The counter shown, made by Nucleonic Corp. of America, Brooklyn, N. Y., sells for \$67.50. A simpler model without the flashing light is less expensive.



The 1-house's "signature," but were to proper level to make a plant toppe should with a first part of the first part of

## Photos of Secret A-Bomb Test

WHAT went on during the hush-hush test of deadher atom bombs in the spring of 1948? The curtain has been partly lifted with release of these pictures. But the

Atomic Energy Commission still won't say more about the bombs themselves than that there were three, "each of improved design," and they all went off.

END



These blocks and cable were part of a gadget that collected samples of sea water after explosion.



Concrete "igloo," near detonation point, contained instruments to record data during blast.



Men aboard Navy ship turned backs or shielded eyes with glasses at instant of detonation.



After explosion, beheopter picked up ocean samples from raft attached to water-sample cable.



#### Hornets Relp Atom Engineers

Witen uranium atoms are split in atomic engines, barium is formed. Hornets collect barium. So miclear engineers propose to keep hornets around reactors—and detect leaks by checking the hornets periodically for radioactivity.

#### Mouse tan't Lose an Atom

The mouse in the glass house at right has caten food containing radioactive carbon Scientists are following it through his body. This apparatus collects all the air he exhales and all other body excretions.





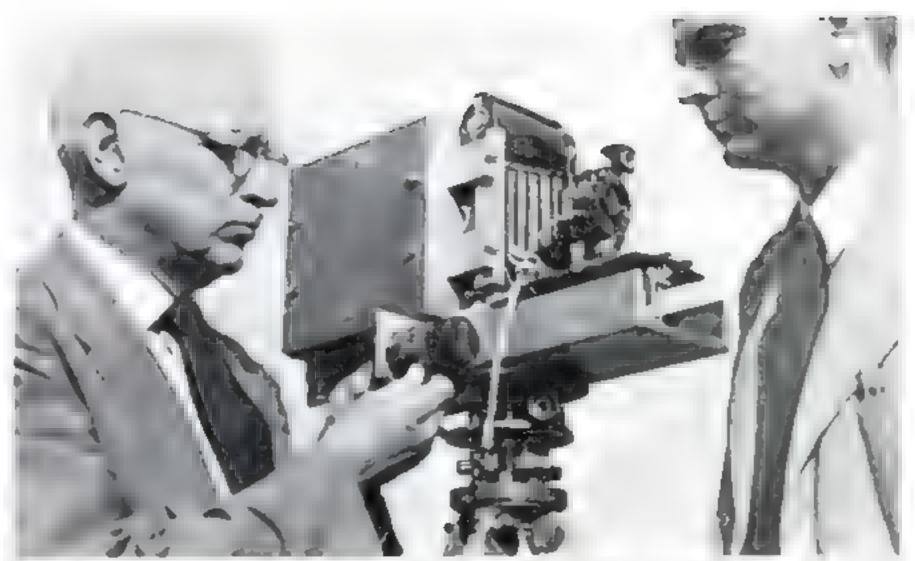


### Kaiser Utility Sedan Converts to Tent

THE sedan that converts to a truck now converts to a tent, too. A steel frame and canvas tent fit over the opened deck hid and tail gate of the Katser Traveler and Vagabond (PS, April '49, p. 106) to provide quarters for overnight lodging. The waterproof duck and drill tent, which measures 6% by 6 by 4 feet when open, can be folded

or unfolded in two minutes. It is reported to be insect- and vermin-proof.

The photos above show LeRoy Smelker, inventor of the Travel Tent®, attaching the frame to the deck hid and standing beside the erected tent. Available through Kaiser-Frazer dealers, it is made by Albed Cloth Specialties, Inc., of Greenville, Ohio.



Second-hand and war-surplus materials make up most of 360° camera. Front end is old Auto-

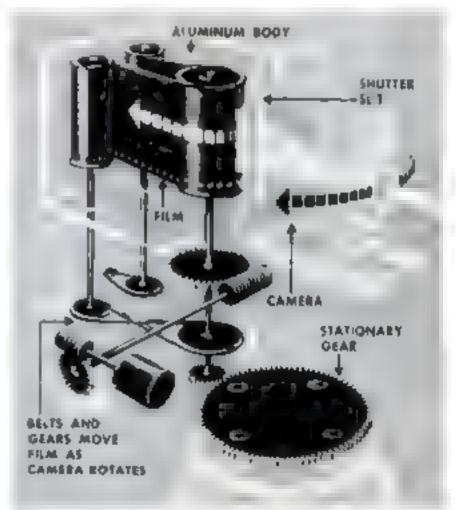
graphic Kodak<sup>®</sup>. Drive motor, film are surplus; leveling table came from a junked transit.

### Spinning Camera Covers 360°

A CAMERA that rotates to get a view all around itself on one negative can now simplify map making. It gives a picture 41 inches long and six inches wide—the two ends overlap slightly to complete the circle. Measurements on the picture then permit quick preparation of a fairly accurate map.

Eliminating the difficult task of accurately joining separate photographs made with ordinary equipment, the homemade 360° camera is an adaptation of the old "panorama" camera used to photograph large groups of people. It turns on a large gear that simultaneously moves the film past an exposure slit.

Two students at Rensselaer Polytechnic Institute, Ralph B. Grahl, Jr., and Robert B. Jarvis, designed and made the camera as their master's-degree thesis.



How it works is shown in drawing above. Motor rotates camera around large stationary gear (bottom), thus causing worms, gears, and belts to move film in synchronism past exposure slit.



Photo shows Rensselser campus. Note overlap—building corner, stairs are at both ends.

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Planes Become Water Babies. The three aircraft pictured above are showing off their newly acquired aquatic ability with a splash. At left, a Convair L-13 makes its first water landing, chalking up another

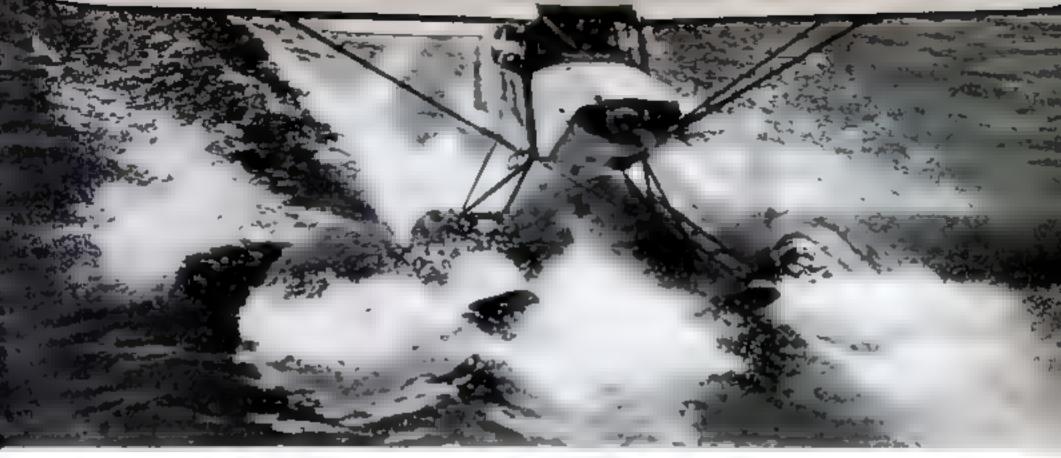
achievement for the Air Force's jack-of-all-trades haison plane. Next to it, a Sikorsky H-5H, claimed to be the first helicopter with amphibious landing gear, takes off after a sea landing. Developed for the Air Force, it



New Brake Device Stops Skids. Even on icy runways, a plane with a new Boeing attachment shouldn't skid. An electronically controlled valving unit, shown above installed on a main wheel of a Stratofreighter, opens to cut breaking power a second before the skidding point would be reached. The outside portion, to which the engineer is pointing, is a slotted driving link that engages hub-cover pins. Housing behind it hermetically seals the rest of the device. There is one unit on each of the main wheels.



Electronics Spot Engine Fault. A new version of the Sperry airborne engine analyzer (PS, Nov. '47, p. 109), the portable unit above is designed for use by ground crews servicing planes not equipped with the flying model. Made to suit any engine now in airline service, the 41-lh, analyzer detects vibration, detonation, and ignition troubles. Patterns appearing on the oscilloscope at upper left indicate and locate engine failures. It also can be used in engine- and fuel-research projects.



has both floats and wheels, as shown in the photo, making it equally at home afloat or ashore. At far right, the seaplane version of the Piper Clipper® comes in for a water-spray setdown on its Edo floats. A sportman's spe-

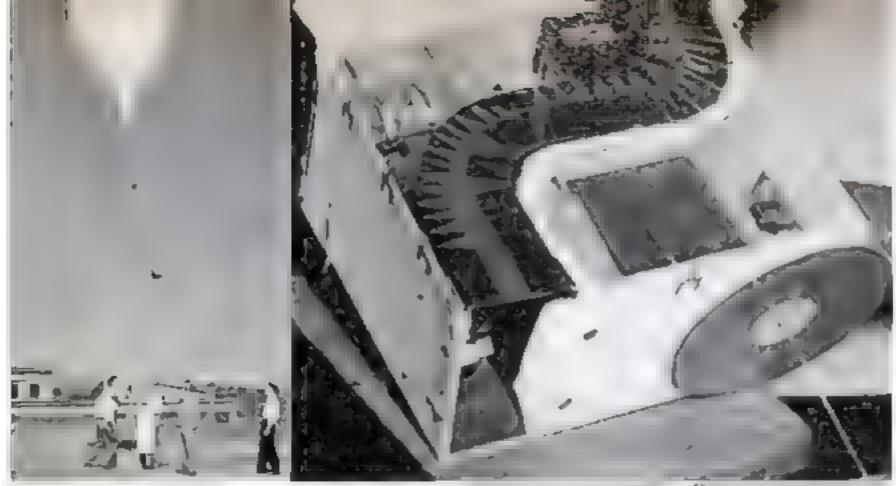
cial, the water Clipper can carry a cance in sections, an outboard motor, and complete camping equipment for an extended two-man wilderness vacation. Like its landplane companion, it has a 115-hp, engine.

Ronanza Adds an Engine. Artist's sketch at right shows how the Beech Bonanza® will look in its new two-engine version now being built. Although the fuselage and cockpit configurations are similar, the familiar V tail of the single-engine job has given way to a single fin and rudder tail assembly. It is being designed as a five-place airplane, to sell at around \$30,000. The engines are reported to be 185-hp. Continentals. The Twin Bonanza, or Model 50 Beechcraft, debut is expected early in 1950.

New Navy Giant Built for Speed. When this 60-ton flying boat, the XP5Y-1, takes to the air this fall, Convair engineers predict that it will cruise at 350 m.p h. With four Allison turboprop engines,

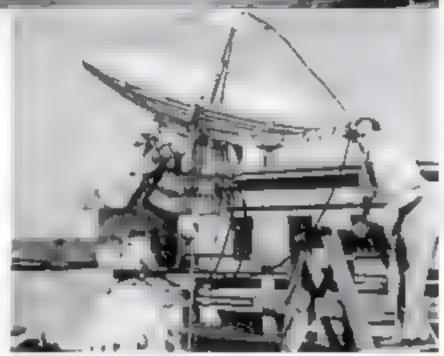
it will have more take-off power per pound of aircraft than some modern fighter planes. This isn't guesswork. Radio-controlled models put it through its paces even before construction began (PS, June '49, p. 120).



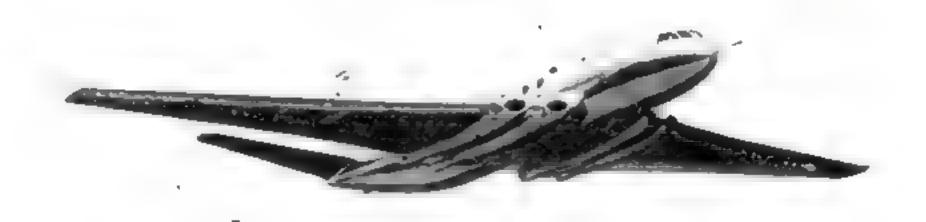


### Flying Box Analyzes Clouds

Navat weather observers can now measure the size of clouds and take their temperature—all from the ground. A new GI "CI nid Analyzer" is carried aloft by a balloon (left above), it radios data to ground equipment (right) that records it on moving strips of paper. A salt-saturated string (inside S-shaped duct at right above), whose cectional resistance varies with the moisture it picks up or loses, tells a cloud's height thickness, and consity. Other instruments record temperature, air pressure, humidity



### World's First Jet Air Liner Makes Flight Debut



BRITAIN jumped the global gun in the race for commercial air supremacy with a recent announcement that its giant de Havilland Comet, first all-jet air liner, had made successful flights. After nearly three years under construction in secrecy, the sleek, sweptback-wing craft has been unveiled. Above, it is shown in its first test flight at

Hatfield, England. Four Ghost turbojet engines, each developing 5,000-lb. thrust, are designed to give the jet liner a cruising speed of 500 m.p.h. A pressurized cabin will permit it to fly at 40,000 feet. Expected to be in commercial use by 1952, the Comet will carry 36 passengers and a crew of four. Sixteen of the planes are being built.



He isn't going anywhere, and he hasn't had an accident. It's just Hollywood's way of converting a convertible into a three-piece figsaw puzzle to simplify photographing actors inside the car.

# Come-Apart Cars Let Camera In

### By Louis Hochman

If YOU didn't look too closely, you'd say that was a neat-looking convertible the movie stars were getting into on the studio lot. But if you looked again two minutes later, after a couple of stagehands got busy with it, you'd wonder why you didn't hear the explosion that blew the car into so many pieces all over the set.



Here's the convertible all together again and ready to drive away—or so it seems on the screen. The camera doesn't show that it has no wheels and no engine under the hood.

Fact is, the car wasn't blown apart. It was taken apart, section by section, to give the camera an unobstructed view of the performers inside it.

The ingenious car-that-comes-apart is a brainchild of Dick McWhorter, assistant director at Paramount Pictures. When Dick came back from the war to his movie job, he was amazed at how much costly production time studios wasted while prop men improvised mock-up car bodies for interior close-up shots.

For a scene that called for close-ups of actors in a car, prop men would either build a wooden mock-up to order, or hack up an old car body and remove sections that interfered with the camera and lighting angles.

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Car aplits in two as special leverage clamps are unbooked and the sections pushed apart. Each main section of the come-apart cur rests on its own steel frame and rolls away on dolly wheels

You've got to adjust yourself to the steering wheel of your car, but the movie driver doesn't. As shown above, a bracket allows the steering column to be set at any desired angle.

manufacturers — are fitted to special steel frames with arched leaf-spring suspension

The mock-up would be mounted high on wooden dollies, necessitating a platform for the actors to walk on. And all too frequently, when the director called "ACTION!" the sound men would tear their hair as the mock-up groaned and squeaked under the actors' movements.

Why, thought McWhorter, couldn't somebody take a regular car body, cut it into convenient sections, and rig it with clamps and fittings so you could take it apart any way you wanted—and reassemble it just as easily?

Testing his hunch, he picked up a wrecked '41 Plymouth at a junk yard and had a welder remodel it into break-away sections. This first model, crude as it was, made such a hit with the studios that he soon founded the Studio Process Body Company, which he runs as a highly profitable sideline with Manager Frank Bettis and Chief "Gismologist" Bill Thompson.

Today, his garage off Hollywood Boulevard houses 10 jigsaw-puzzle cars, a sectional wooden bus, and an ambulance, all in constant demand by movie studios. Not only are they cheaper than the custom-built mock-ups formerly used, but actors and technicians find them easier to work with.

The cars — stock bodies bought without their mechanical innards from automobile

manufacturers — are fitted to special steel frames with arched leaf-spring suspension and large steel dolly wheels. This welded frame is designed to support the body at normal car height and give it the same motion as an automobile moving on the street. To simulate bouncing, a stagehand slips a two-by-four under the frame and rocks it on cue.

Squeezing a cameraman into the back of this Dodge truck for a rear-angle interior shot would be the hard way to do it. Removing the entire rear panel as shown below is much simpler.







Filmland driver can't see where he is "going" in relation to projected rear-window movie land-scape. So assistant at right steers wheel for him with crank to insure correct turns of wheel.

The moving landscape seen through the windows is really a movie projected on a translucent "process" screen behind the car.

Most of the cars fall apart into three main sections, which in turn come apart into as many as 20 to 25 pieces. Steel roofs are cut up into removable panels to let light and microphones come in from above. Doors lift

There are lots of tricks to the jigsaw-puzzle cars. Below, a snub-nosed front converts a truck into a cab-over-engine model. Interchanging parts make it possible for one car to play many

neatly off their hinges for side-angle shots.

For front views, hood, windshield, and cowling separate from the rest of the body, leaving the front seat and the driver exposed to the camera. Since the doors and steering wheel show in this angle, they are held on by special brackets that even permit them to function normally. But the actor at the wheel can't see the landscape receding on the process screen behind him and doesn't know which way to steer. So he merely holds the wheel loosely and lets a stagehand do the steering by remote control—a long crank handle attached to the base of the steering post.

To let the camera shoot through the windshield, all glass can be slid out of the frame, giving clearer pictures of the people inside. Or maybe you want a driver's-eye view? The entire rear half of the car can be detached and rolled away.

Falling apart in the right place at the right time does not exhaust the tricks possible with these movie cars. Although Studio Process has only 10 complete car bodies in stock, those 10 can be made to represent almost any make or model needed.

There's an ingeniously designed 1949 Buck sedan that can assume nearly any name from Ford to Cadillac, simply by switching a few of its parts. A '48 Dodge sedan is changed into a Chrysler Town and Country® by replacing its doors with wooden station-wagon doors that have been cut down to fit. Substitute small cabbie seats and a glass par-

roles. With slight but ingenious changes, a 1949 Buck sedan can double for a Ford, Mercury, Lincoln, Cadillac, Oldsmobile, Chevrolet, Pontuc, Kauer, Frazer, or Dodge.





Mickey Knox takes Locetta Young for a ride during filming of The Accused Man well concealed by movie camera and lights at far right uses a plank as a lever to bounce the truck on the from the director. Photo at lower right shows how the scene appears to you on the screen.

tition for the front seat of a '41 Plymouth and—prestol—it's a Yellow Cab. Even a truck body can be regular style or cab-over-engine, depending on which hood is hooked on.

Each main section of a come-apart car sits on its own steel frame and rolls away on a dolly. When brought together, the sections center themselves and slide snugly into place on disappearing doll pins. Specially designed leverage clamps that work on the same principle as trunk catches pull the sections tightly together and automatically lock them in place.

Because of the strange alterations these car bodies undergo, practically every book, clamp, screw, and bracket has to be made by hand. All this complicated work is done in a small corner section of the shop.

Here, "Gismologist" Thompson goes to work on stock car bodies with an acetylene torch, cutting them into sections, smoothing and upholstering the rough ends, and fitting



them with disappearing doll pins and leverage clamps. To obtain a satin finish—better photographically than the customary high gloss—Thompson has a trick of mixing his paints and spraying them on from just the right distance so that the spray is partially dry by the time it hits the surface.

Started in September of 1946, the business has flourished nicely in its short three-year life. The jigsaw-puzzle cars have appeared in more than 100 films, the more recent ones being Criss Cross, The Accused, Race Street, A Crooked Way, and Bitter Victory.



#### **Watch Tells Tide Time**

This Swiss-made chronograph tells tides as well as time. Once set to the tide schedule of any seaport, it shows the rise and fall of tides at that point on two small dials (left and right), one for high tide and one for low. It automatically advances the time of the tides twice a day—about 25 minutes every 12 hours—as the tides themselves advance. Designed for fishermen and sportsmen, it also offers stop-watch, elapsed-time, time-out, and other chronograph features. Called the Seafarer<sup>0</sup>, it's sold by Abercrombie & Fitch, New York City, for \$96.



### Locomotive Light Looks 3 Ways

This new emergency light for locomotives rolls its eye to warn motorists and other trains. A single, offset reflector, rotated by a small motor, gives its 650,000-candle-power beam a gyrating motion for greater attention. This white light is used as an extra warning to motorists at grade crossings. When the train makes a sudden stop, a red filter slides over the lamp, and the light shines a red beam to warn approaching trains. And with the reflector kept stationary, the white beam can serve as an emergency headlight. The three-way light is made by the Pyle-National Co.

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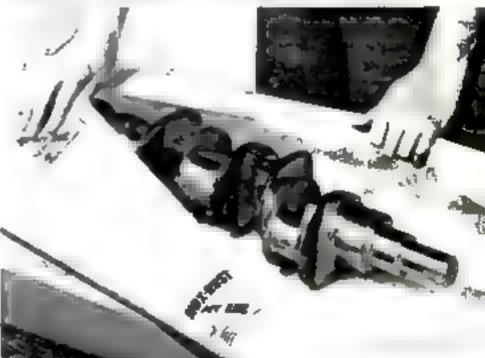


### "Iron Lung" Weighs One Pound

RECUPERATING polio patients are freer to move around when wearing this one-pound "iron lung." Called the Monaghan® respirator, it consists of a rubber-plastic chest plate connected to an electric pump by a seven-foot hose. The pump creates an intermittent vacuum in the chest plate, causing the patient's lungs to draw in air. The respirator works on battery or house current and can be regulated to suit the patient's breathing rate.

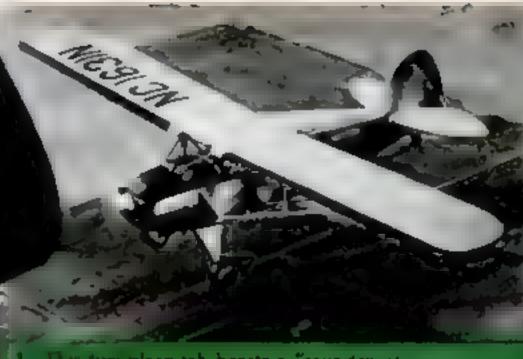
### Paper Keeps Rust off Machinery

Inon and steel machinery parts wrapped in this Nox-Rust Vapor Wrapper® can be stored from three to five years without rusting. Used like ordinary wrapping paper, it is impregnated with a chemical that slowly vaporizes, creating an atmosphere that prevents corrosion even in the presence of moisture. Made by Nox-Rust Chemical Corp., Chicago, it is said to eliminate the need for special coatings and containers.



### How's Your Plane IQ?

You've probably seen most of these personal planes buzzing around your local airport. See how many you can identify, then check the answers pointed upside down across the fortune of those pages.



This two-place job boasts a "soundproof cabin and a landing speed as low as 37 mph. Plane also has steerable tail wheel



4. Low price entry among four placers, its name is one of most familiar among light planes. It has very short span and wide chord.



L Fixed landing gear is an economy feature U. on this high-wing, high performance 185hp. four-seater. Note squared tail surfaces.



O A record nonstop flight from Hawan to U. New York was charked up recently by one of these V-tail, all-metal, low-wing ships.



I Here we have a high wing and fixed landing gear on another four pussenger auplane. A 145 hp job, it cruises at 114 mp h.



2. All metal, tapered wing and big staps for tures of this popular four-placer



3. This is another all metal four-seater but 3. low-winged and more powerful it has retractable landing year and 7 calm windows



6. Fast is another name for the all metal. low wing, two-place plane above it cruises at 140 mph and lands at 48 mph



High, sloping he gives improved directional atability to a plane named after a proper aviator and light plane designer



10. High performance in this plane means 10. 165 mph and a climb to 22,000 ft in 50 minutes, It has a 150-hp. Frankin engine



11. Twin rudders and fixed tricycle landing leger are vour clues to this 75-lip twoplaces with an extra seat for jumor



First step in porcelain enameling is processing the glass. Molten glass from the crucible is poured.

into cold water, which chills it so fast it shatters into millions of small particles called "frit."

### Table-Top Porcelain Plant

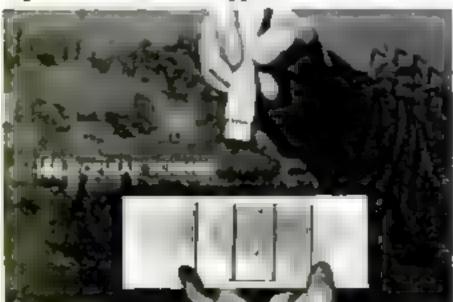
A FACTORY that fits on a table top shows how your porcelain-enameled refrigerator got its glassy finish. It demonstrates the steps by which glass is powdered, then fused onto a metal base, forming a hard, easily

cleaned, decorative surface. Dr. M. J. Bahnsen, research director for Ferro Enamel Corp., Cleveland, developed the miniature plant. It's used to boost sales of enamel-manufacturing equipment and supplies.



Beakerful of frit (right hand) is ground in porcelain-lined ball mill (left hand), with clay, water, and ceramic pigments. The result is a thick, creamy mixture known as "slip."

Before final baking, identifying marks or decorations may easily be stenciled on. These become a permanent part of the finish. Another coat of powdered frit is then applied.

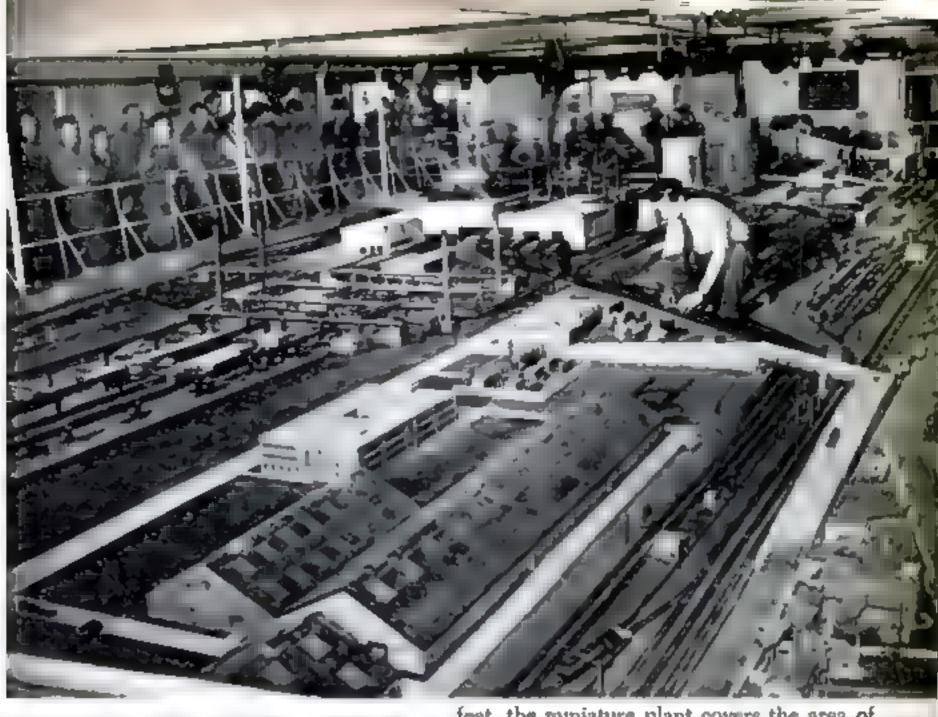




Metal panel to be enameled is dipped in the slip mixture. (This may also be sprayed on.) It then gets a preliminary drying in the furnace, leaving a dull, claylike finish.

Metal is then fixed in a miniature electric furnace at temperatures of 1,500-1,600° F. Heat melts the frit coating, fuses it to metal backing as a permanent, glass-hard coating.





### Huge Model Shows Steel-Making

IF THE model steel mill were life-size, it could turn out 10,000 tons of steel a week. Although built to a scale of one inch to six

feet, the miniature plant covers the area of a tennis court. It shows every step in steel production from ore boat to finished metal and everything works. British Iron and Steel Federation showed it in London.

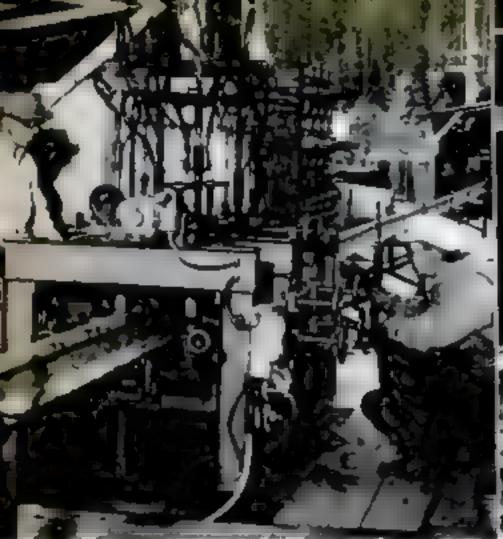
### Mike Dampens Dog's Bark

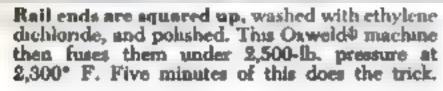
This device really dampens your dog's enthusiasm for baying at the moon. A microphone, amplifier, and valve combine to squirt water at the dog if he barks. He soon catches on, says W. J. McGoldrick, Minneapolis-Honeywell engineer, who tried it on his dog.

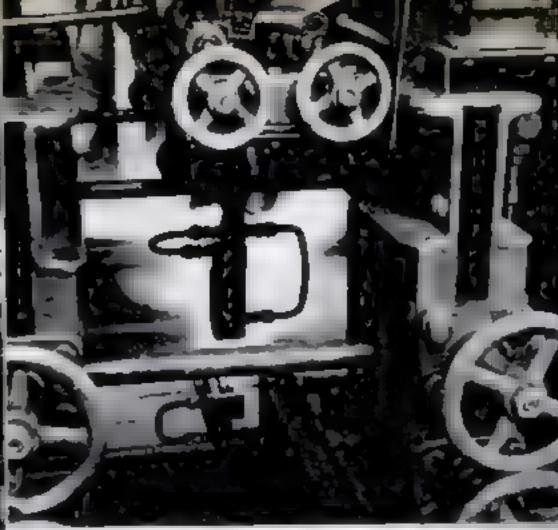
### Steel Fingers Harvest Hops

A new machine harvests hops as fast as 300 handworkers. Moving hooks pull the vines past steel fingers (below) that knock off the fruit. Stems and leaves are vacuumed away. Rubery, Owens & Co., Ltd., of London, makes the harvester.









Close-up shows a few of the 125 welding tips that join the 39-foot rail lengths. After welding, joints are trimmed, ground, and polished to a velvety smoothness by a series of machines.

The heavy steel flexes easily around fourdegree curve. Flatears can handle up to 12 rails simultaneously, but only three are loaded since narrow tunnel restricts train movement.

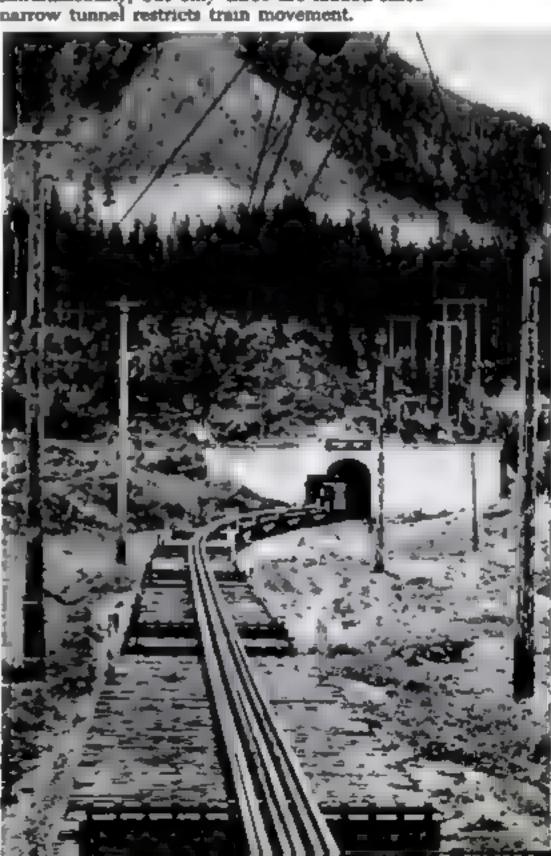
### 4-Mile Rails Save Work In Tunnel

TRAIN passengers riding through the Great Northern's Cascade Tunnel at Scenic, Wash., no longer hear the familiar clickety-clack of the wheels over rail joints. Continuous rail, pressure-welded on a special assembly line, has eliminated conventional joints over four of the tunnel's 7.79 miles.

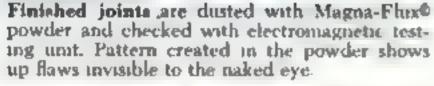
Longer service life and reduced maintenance costs are expected to repay the \$189,-000 laid out for the project. No joints means no pounding of rail ends by wheels. On ordinary track, these impacts flatten rails, weaken joints, beat down the roadbed, and chew up ties. In the cramped quarters of the single-track tunnel, longest in the Western Hemisphere, repair can be a bottleneck.

The assembly line pictured here, at the west portal of the tunnel, last summer rolled out 1,300 feet of rail per day. Flatcars hauled the sections into the tunnel, where they were spiked down and the remaining joints handwelded.

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To unload, rail is clamped to anchored steel cable at tunnels end. Cars are then pulled from under it, the rail slipping easily over the rollers. Section gang waits at the right to move in, spike



Lengths of welded rail are loaded with help of rollers on string of 25 flatcars. Worker tightens a clamp near center of 1,300-foot section to prevent lateral shifting during ride into tunnel.

the rails to the ties, and hand-weld the joints between lengths. Next year the remaining 3.79 inites of rail in the tunnel will get the same treatment, according to present plans.

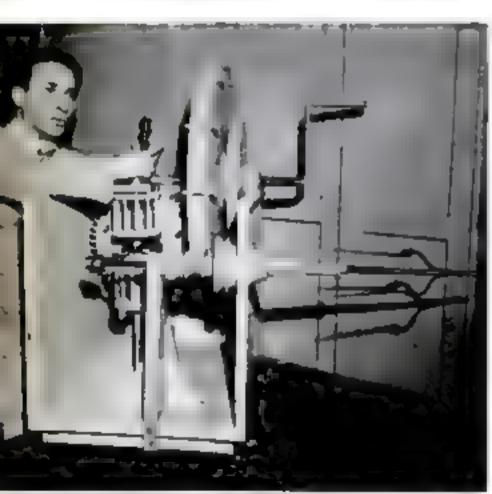




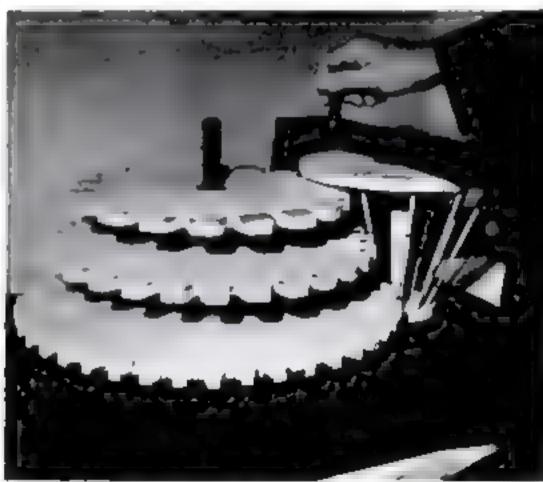
Of the many types of bridges designed by da Vinci, the rotating cantilever model shown above was one of his most important contributions to the defense of a military position. Intended to connect an island fortress with the mainland, the bridge could be swung away when not in use. Its construction principles are still in use by bridge builders today.

### Leonardo Comes to Life

If POPULAR SCIENCE had been published some 450 years ago, it undoubtedly would have carried these items in its "New Ideas from the Inventors" section. A three-speed power transmission, a form of which you use in your car every day, is but one of



Here is an ancestor of the modern flyer spindle. A complicated arrangement of gears enables an operator turning handle at upper right to wind thread smoothly on revolving spool below it.



The variable-speed drive can be credited to Leonardo. As shown here, he meshed three cogged wheels of different diameters with one central (lantern) wheel, seen being turned at right.

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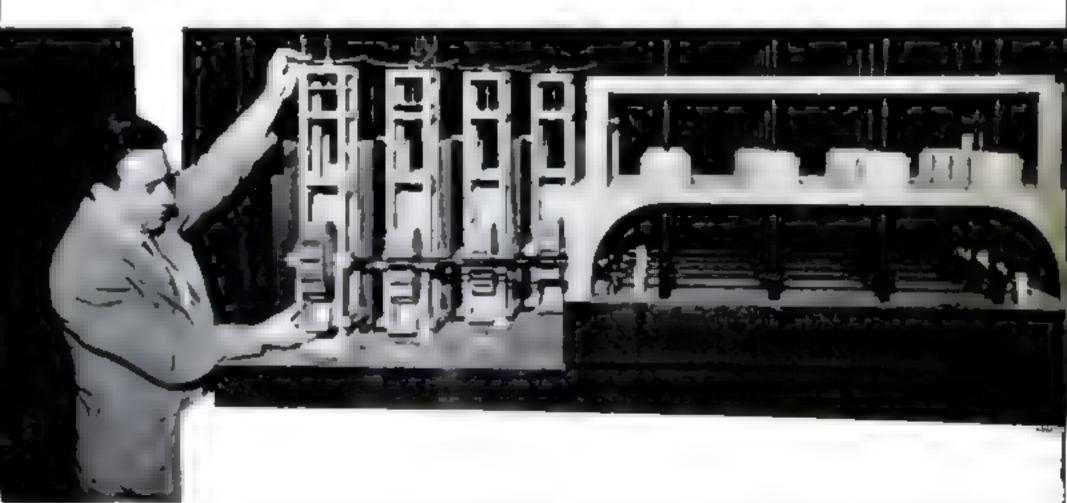
A forerunner of shrapnel, this senal projectile was one of his many military weapons. When coiled fuse burned down, the disk exploded, scattering the bullet-like spokes embedded in it.



This hand-operated minting press is believed to be the first to stamp both sides of a coin simultaneously. Weight, shown being raised, is released by the pherlike device seen at top.

the more than 300 machines, weapons, and other inventions designed by Leonardo da Vinci, famous 15th-Century Italian artist.

Now 66 of these have been re-created by Roberto A. Guatelli, an Italian-born mechanical engineer, in faithful counterparts of the originals. These models not only illustrate mechanical principles discovered or adapted by Leonardo; they actually operate. Working in the Los Angeles County Museum from the old sketches, Guatelli built his re-creations mostly of hard wood.



A mechanical version of today's massive hydroelectric plants is the da Vinci grinding mill shown above. A set of grinding machines, seen at right, was placed on each bank of a swiftly

moving stream. Power was furnished by a series of water wheels, shown at left, located in mid-stream and connected to the grinding weights by a system of shafts and gears.



Barton's benthoscope is hauled up by cable after \$40-ft, test dive at Long Beach, Calif. Two powerful, externally mounted searchlights give illumination within a radius of 10 feet.

OTIS BARTON, New York scientist, likes to get to the bottom of things. This time it is the Pacific Ocean off the California coast. He hoped to sink himself below its waves to twice the 3.028-foot depth he reached off Bermuda in 1934. That was in the famed bathysphere he built for William Beebe.

His new vehicle is a thicker-shelled, hollow, two-man steel ball mounted on three huge, wide-tread, wooden wheels. His oceanbottom trailer is towed by a ship, enabling

There's not too much room for Barton, seen below peering through port of his 52-in. diameter sphere. It is made of chrome-nickel steel 1% in. thick, and has two fused-quartz windows.

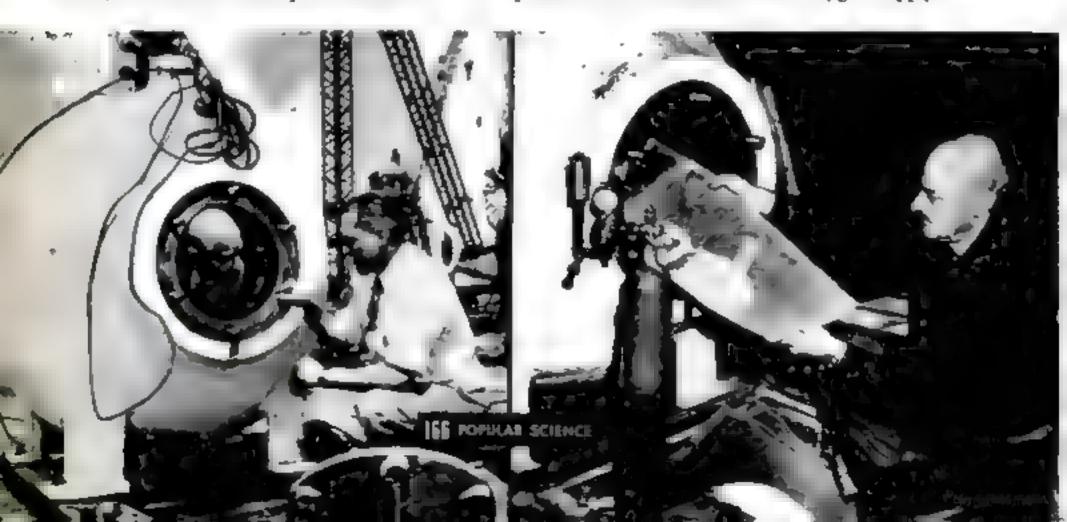
Artist's conception at right shows fish's-eye view of oceanfloor explorer in action. Main wheels are old cable draws

## Ocean-Bottom Cart Explores New World

him leisurely to study strange marine life and undersea canyons.

Called a benthoscope—meaning "view of the ocean depths"—Barton's oceanic crawler already has come through "wet runs" at 40 feet. The project is sponsored by the Hancock Foundation for Scientific Research of the University of Southern California. If the Pacific perambulations were successful, Barton saw no reason why he couldn't roll his way across the "not-so-deep" Atlantic.

Breathing in the benthoscope is a problem. Below, the inventor is loading trays of soda lime that absorb carbon dioxide exhaled by the occupants. Tank at left holds 16-hr, oxygen supply







Operator puts trees from eide bez into trench



Plow holds trench open, does not turn soil.



Wheels (under seat) pack soil around roots.

### Sled Plants 1,000 Trees an Hour

A THOUSAND trees an hour can be planted with the help of a small steel sied that digs a narrow trench, holds it open long enough for the seedling to be inserted, then closes it and packs the earth around the seedling's roots. Designed particularly for use in the Northeast, the TreeP® has a special cutter for slitting stony soil, a larger one for other types of soil. Retractable front wheels are used for towing the sled between jobs.

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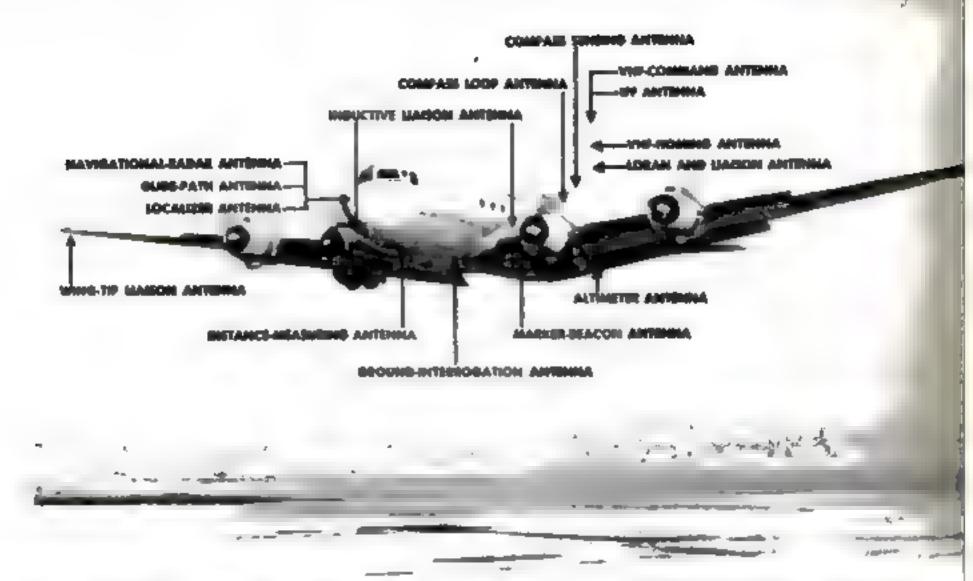
### "Landing Gear" Adjusts Trailer

Where units that retract like the landing gear of an airplane permit this trailer to adjust itself to the height of a loading dock. A small gasoline engine powers the hydraulic mechanism — visible through door in photo above—that raises and lowers the wheels as much as 53 inches. Each wheel unit works independently of the other. A. M. Meldrum (above), San Francisco, invented the Hi-Lo Trailer® after two years of experimentation.

### Hypo Needle Paints Dials

Tens hypodermic needle squirts paint. It is used to letter dials — such as the compass dial shown below—with luminous paint. E. L. Bermuda, of the Air Force Depot at San Bernardino, Calif., made the device by fitting a sawed-off hypo needle to a steel cylinder and plunger. He reports it's easier and faster to use for fine work than a brush.





There are 16 hidden or flush-mounted antennas in this Air Materiel Command's C-54 flying

laboratory, used to test new developments. Buried, the antennas add nothing to aerodynamic drag.

### Antennas Go Into Hiding

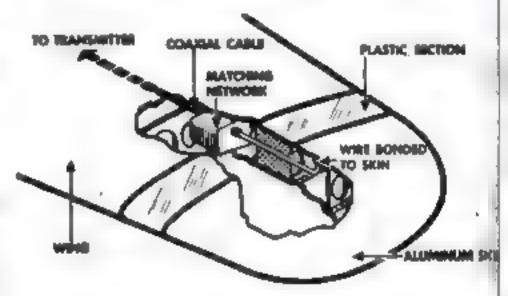
RADIO and radar devices have been added to airplanes so rapidly that with the accompanying exterior antennas the planes were beginning to look like flying porcupines. And in their other role, as gremlins, the antennas were acting as brakes on the high speeds the Air Force was aiming at.

As one radio expert put it, "When they take the propellers off, then we'll take off the antennas." Along came jet propulsion, and, true to his prediction, the experts are burying the antennas to give the speed-of-sound-nudging planes clean-swept exteriors.

As an example, figures compiled for only nine of the 16 hidden antennas on the experimental C-54 at the top of this page show that these antennas, if mounted externally, would use up 634 hp. at 600 m.p.h. That's enough horsepower to pull half a dozen automobiles.

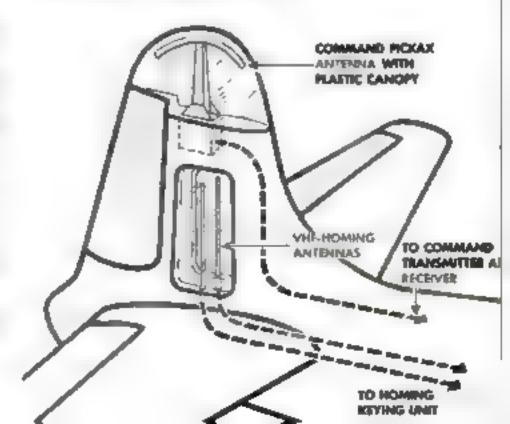
Among the other advantages of buried antennas are the elimination of icing dangers, added protection against precipitation static, the sealing out of moisture, and freedom from the threat of aerials breaking off at high speeds and interrupting communications.

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A sero-drag antenna, buried in a wing tip, is shown in the above drawing. Plastic section isolates tip from rest of wing. If necessary, plane's entire wing can be used as an antenna.

Pickax antenna shown at top of drawing below was the first type of hidden antenna. Designed to follow conventional curve of plane's tail, it is protected by a plastic canopy.

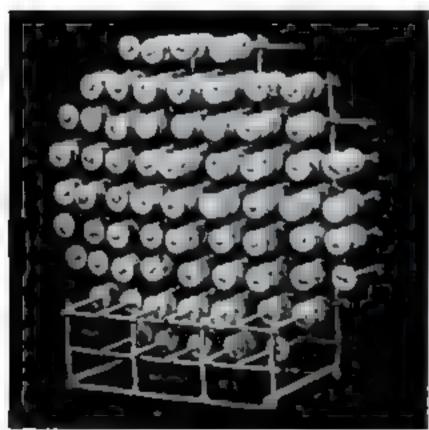




# Lenses Promise No-Hands Phone

BEING a good engineer, Dr. Winston E. Kock is a lazy man. He thinks it's too much trouble to lift up a handset every time you want to talk over the telephone. His idea of a telephone is a little black box you never touch—just talk and listen to.

Since Dr. Kock is a physicist-engineer for Bell Telephone Laboratories, he did something about his idea. He developed lenses that focus sound, a necessary preliminary to the lazy-man's telephone. The telephone it-



Sound lenses can be made from many kinds of materials. The one above consists of metal disks on an open framework. It was originally built for microwaves, but works just as well for sound.



Circular sheets of perforated metal make another type of acoustic lens. This particular model, however, cannot be used to focus microwaves, which are reflected by the metal sheets.



Microwave ancestry of sound lenses is shown by using one lens to focus both types of waves.

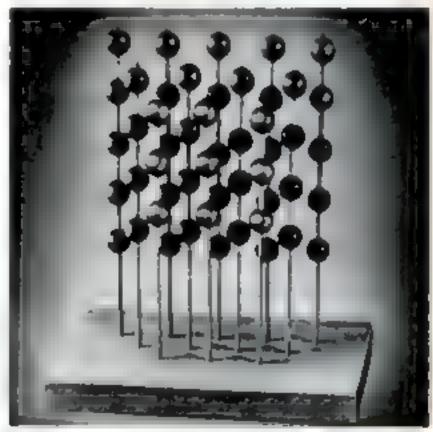
self is still only an idea, but the lenses have been made and should have many uses.

You can understand why lenses are necessary if you've ever held an old-fashioned telephone receiver near the transmitter. The transmitter picks up the receiver's sound, which keeps going around the circuit until it is a howl. A lens would direct the receiver's sound at the user and keep it away from the transmitter. ("Intercom" systems do have combination receiver-transmitters, but you must press a switch to talk-more work than holding a handset.)

The sound lenses grew out of Dr. Kock's research on lenses for microwave radio relays (PS, Aug. '46, p. 90). A little figuring showed that sound and microwaves have the same wavelengths (although they are very different otherwise); so they should be focused by the same lenses. And they are, as Dr. Kock proves by sending both through the same lens, as shown at the top of this page.



Spreading high-pitched musical notes from single speaker may be use of lens. Since high frequencies are directional, good radios now must use two "tweeters" to distribute music.



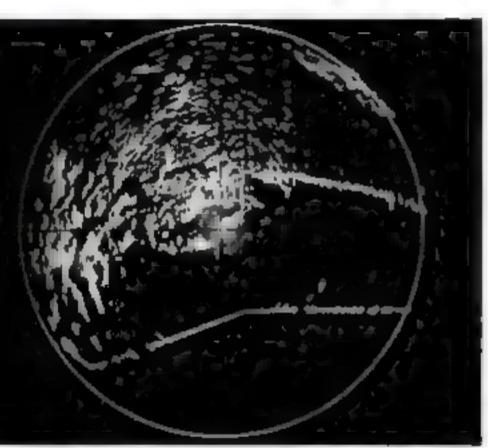
Bails are used for this lens. Acoustic lens works just like optical kind: difference in thickness between edge and middle slows some waves more than others, making them focus at a point.



Reder tower and pilot station landmark outer harbor at Long Beach, Calif Scanner is located on top of the 122-foot steel structure.



2 Position of an incoming ship is being plotted on a harbor-area chart. The port makes no extra charge for the radar-piloting service.

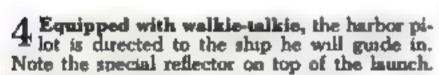


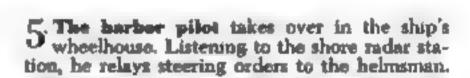
3 Long Beach Harbor is shown on a radar viewing scope. Line across bottom is break-water, Elongated pips are ships; dots are buoys.

### Radar Talks Ships into Port

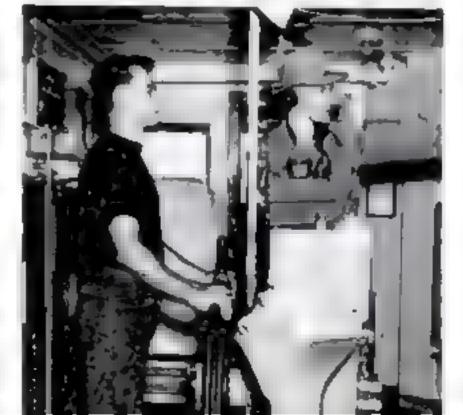
TAKING a tip from aviation, the Port of Long Beach, Calif., has installed a radar system to guide ships safely into and out of the harbor in even the foggiest weather. It works much like the Ground Control Approach radar system by which an airplane pilot is "talked down" to an airport runway.

The harbor pilot is radar-guided to a ship, which he then boards and maneuvers in, obeying instructions sent from a shore station where the ship's course is constantly followed on a radar scope. The new system, first in America, makes it possible to locate ships 30 miles away. The electronic equipment was supplied by Sperry Cyroscope.











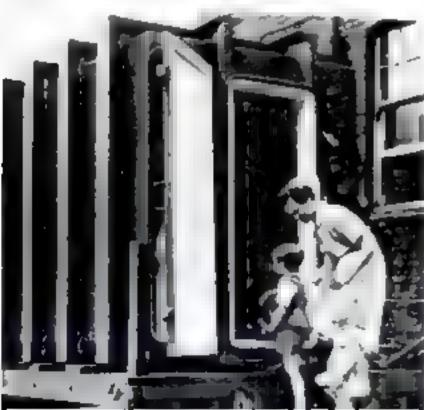
### "Carfeteria" Serves Motorists at Wheel

EATING is made easy for motorists who patronize the wheellike Los Angeles Motormat shown above. Spokes of the wheel are tracks along which run small carriages. You drive into one of the 20 stalls, where a carriage and menu are waiting, make your selection, write the order, and press a button.

Presto! the carriage whizzes into the kitchen, stopping along the way only long enough for an attendant to figure the cost. In a few minutes the meal is shot back to your car. When you have finished eating from a lap tray, you put the empty dishes back in the carriage—plus the price of the meal.

### "Flight" Chamber Fights Disease

During the war British pilots used the decompression chamber to check the effects of breathing at high altitudes. Now it is being used by their children in a war against whooping cough. Small fry suffering from the disease enter the mobile chamber below, where pressure is gradually reduced to the equivalent of that at 12,000 feet. This lowered pressure permits congested lungs to breathe more deeply, speeding recovery. The new treatment, it is believed, may cut recovery time from weeks to a few days.



### **Mobile Bins Save Space**

Wasted aisle space has been eliminated by a new Bratish system of metal cabinets and lockers that roll on tracks. The rows of storage bins below hug each other for maximum space use but can easily be pushed aside for access to the sections in back. Sliding on ball-bearing wheels, the cabinets move easily and noiselessly. It is claimed that the Foulkes Rolstore Mobile Storage® system saves 20 percent in walking distance. Acrow, Inc., of Newark, N. J., is introducing the units in the United States.





## Radio Toasts Wood Sandwiches for Car Bodies

Dielectric bonding cures glue between plywood sheets in a fraction of the time required by older processes. E VER wonder how those smooth curves on station-wagon bodies got that way? The Ford Motor Co. uses radio waves to turn the trick. The radio treatment sticks together plywood sheets for the panels and posts in less time than it takes to tell about it.

This method is called dielectric bonding. High-frequency radio waves of about 18 megacycles—one of the frequencies used in short-wave radio—are shot through the layers of wood. Those flowing body curves on Ford and Mercury station wagons result.

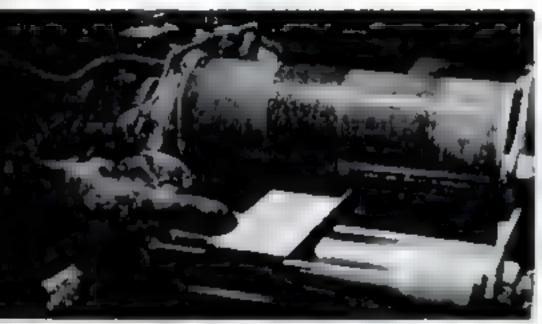
When the radio waves, produced by a high-frequency generator, pass through the wood, they set its molecules in motion. The resulting friction between the molecules produces heat that cures the glue between the plywood layers in four to five minutes. Some 350 to 375 pounds of hydraulic pressure per square inch help speed up the process. The waves-plus-pressure combination raises the wood at the glue line to about 280° F.



Raw plywood veneer is first checked for moisture content, which must be just right, by instrument that pricks wood, measures electrical conductivity, records amount on sensitive meter.



Radio waves for heat bonding are produced by this high-frequency generator an oscillator tube with a tuned circuit consisting of coil and condenser. Fins around edge are for air-cooling.

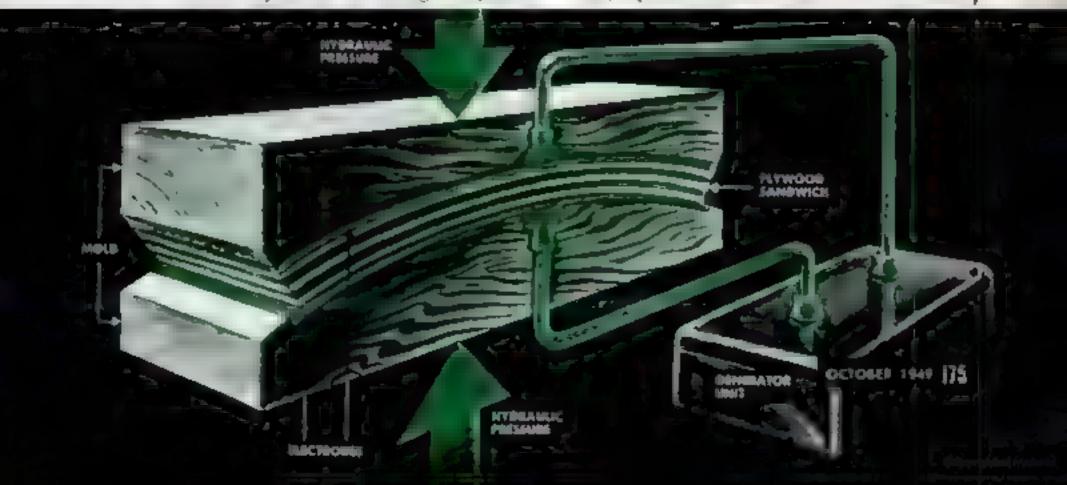


Double-roller spreaders apply give, a special phenolic-resin type, to veneer sheets after they have been cut to size by rotary cutter Narrow strip above will form part of door-frame pillar.



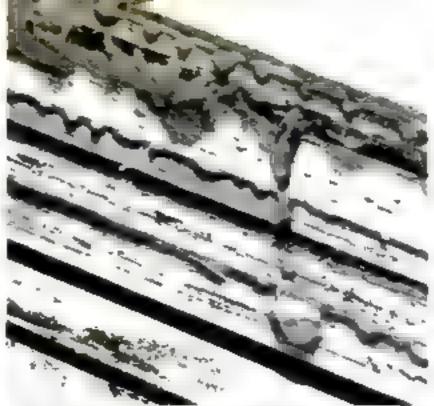
Loosely stacked, glued "sandwich" of veneer sheets for door-frame pillar new goes to forming mold. Pressure of 350 to 375 lb per sq in will be applied hydraulically from above and below.

Drawing below shows how two haives of heavy mold squeeze plywood sandwich between them under hydraulic pressure while high-frequency radio waves are shot in to cure glue. Copper electrodes, connected to wave generator, run along top and bottom of mold next to wood.

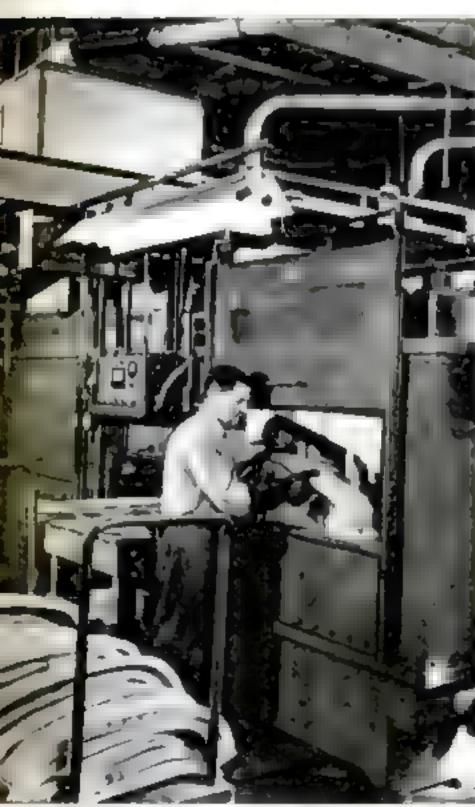




Here workmon removes guides around mold before applying current. He will then pull down copper shield, enclosing mold, to prevent harmful radiation. Molds are made of wood to provide good insulation against loss of heat and energy



Close-up of plywood sandwich shows how excess glue has bubbled out along edge during heat-and-pressure process. Glue is cured in 4 to 5 minutes, but panels remain in molds an additional 3 to 5 minutes under pressure but not heat.



Finished door-frame pillar is removed from press, permanently glued and shaped. Ford now has 18 of these 75-ton-capacity presses. At top left are power and oscillator sections of Thermex® dielectric heating unit. Timer automatically shuts off power in hydraulic press at end of heat cycle.



Plywood panels are bolted directly onto outside of all-steel underframe to form station-wagon body. Panels are so attached that individual sections can be removed and replaced if damaged. Phenolic-resin glue in panels makes moisture-resistant bond that's stronger than wood itself.

#### **Transit Measures New Cars**

EXACTLY how long is a new car? How high and how wide? What's the leg, head, and hip room inside? The road clearance?

To determine these and other dimensions of Ford and competitive cars, Ford engineers use surveyor's transits, a height-gauge manometer, levels, and other instruments. Results are accurate to a fraction of an inch.

The work is done on a steel floor that can be levelled to hairline precision. Transits slide along a railing at one side and one end of the floor. Used as seen in the photo at right, these yield length and width measurements. The manometer, a hourd level device, gives most of the vertical figures.



THE Wix-Lite®, holted to the underside of a car frame, throws a 40' circle of light. Made by Wix Accessories Corp., of Gastonia, N. C., it provides illumination for passing, fog driving, entering and leaving a car, tire changing, and backing. It can be installed on tractors for night work. The lens is shock-resistant plastic. Price is about \$9.

### Retainer By-Passes Grease



LEARACE of excess grease into rear brake drums is said to be eliminated by use of the Thomas By-Pass Grease Retainer® made by South Gate Brake Specialities, South Gate, Calif. This re-

tainer by-passes excess grease to the outside instead of letting it go through the retainer. The backing plate's bottom bolt is left out and grease passes out through the hole. A felt retainer wipes the hub free of grease that's passed to the outside.

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### Pressure Gauge Kept on Tire

PERMANENT gauges made by K. Emsley. Ltd., Bradford, England, guard against underinflation. They work at predetermined pressures. To check, you press a plunger. Unless a bubble appears in a plastic dome, air is low. It's added with the gauge on

### Stethoscope for Mechanics

A STETHOSCOPE-LIKE device, adopted by the Studebaker Corp., probes an engine's innards in much the same way a physician listens to your heartbeat. A metal rod leads to an amplifying diaphragm encased in a plastic housing. Sound, boosted by the diaphragm, travels up to the hearing ends in the mechanic's ears. Outside noises are shut out,



## Gus Prescribes

### By Martin Bunn

Young Dr. Rhodes, fresh from his internahip, has been in our town only a few months. The going hasn't been easy. He finally found a little office and then sweated it out for a couple more weeks while waiting for office equipment. Add to this an old sedan with a chirp that was a cross between an anemic canary and a peanut roaster, and you'll see why Doc was ready to visit a doctor himself.

The older, established physicians were feeding Doe a lot of their night calls. That's why he bought the car. He'd only had it a short time when that high-pitched chirp developed. The birdie only sang when the engine idled or when the car was moving slowly in high.

The squeak while idling was worst. That usually took place at an intersection when he was waiting for a light. Doe, hoping the noise would go away, tried to ignore it.

But the afternoon he stopped at an intersection near the high school — that did it. Mandy Manville was riding with Doc. She's about the prettiest music teacher our high school ever saw and Doc was seeing her regularly, picking her up after classes nearly every day. The squeak started as usual when he pulled up to wait for a red light.

"Listen to the birdie," jeered one of a group

of students waiting for a bus.

"Somebody gave him the bird and he kept it," said another. This brought laughs from the boys and giggles from the girls.

"Maybe we could get him to bring it to our singing class," said the first student. "It might

be some kind of rare canary."

With a very red face, Doc drove away from the intersection. He shot a sidelong glance at Mandy. She was looking at him.

"Doctor Rhodes," she began with mock seriousness, "that bird has got to go—if I have to shoot it myself,"

"I know," he said. "Maybe it will just go away. It just came, you know."

"It sounds as if it has moved in perma-

heard those students back there."
"I did," he replied. "They sounded like uncouth brats. Any of them in your classes?"

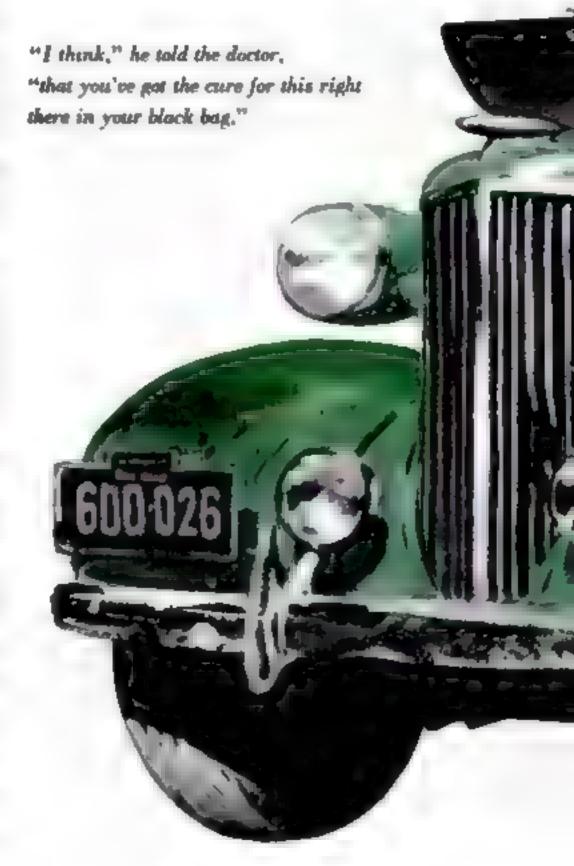
"Yes, and they really aren't uncouth brats. They're just at that age when they think everything is a wisecrack. They don't mean to be cruel—just to be funny."

nently." she said. "I think it likes you a lot."

"John," Mandy said, "I'm serious. You

"I'll put salt on its tail," he told her.

"It didn't sound funny to me," Doc said.



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# for the Doctor

Mechanics who handed out a free diagnosis and then prescribed the wrong remedies were getting the doctor down, especially when they charged him for operations he didn't need.



"Nor to me. It's not the first time," she went on. "The other day I overheard one of them referring to you as Doctor Squeaky. That's not very good for a young doctor just getting his start."

Doe's face reddened again. "All right," he agreed. "I'll take it to a garage as soon as I drop you off. I'll pick you up this evening for the movies."

"I hope you really have it fixed," she said.
"I'm not so sure I want to go to the movies in this car if that bird hasn't been shooed."

"If nothing else," Doc grinned, "I'll personally wring its neck. No bird—especially one with a voice like that—is going to come between us and the movies."

After leaving Mandy at her home, Doc pulled in the first garage he saw. A mechanic, wiping his hands on a wad of waste, walked from the rear of the shop.

"Listen to that squeak," Doc told him.

"I hear it," said the mechanic. He raised the hood and listened for half a minute. "It's the water pump. Maybe a shot of grease will fix it, but you probably need a new pump."

"Try grease," Doc suggested.

The mechanic gave it the grease but the chirping went right on.

#### Tries New Pump

"I guess it didn't need grease," the mechanic said sadly, staring at the engine.

"What's a new pump cost?" Doc asked.

"It'll be \$8.49, including labor,"

"Okay," Doc sighed, "put on a new pump."
While the mechanic worked, Doc stood around and watched.

"All right, start 'er up," the mechanic said at last.

Doc started the engine and the squeak started too. Doc looked at the mechanic. The mechanic shrugged his shoulders.

"I thought you said it was the water pump," Doc accused. "Or do all the new water pumps come complete with squeaks?"

"I guess I was wrong," the mechanic admitted, "but you needed a new pump anyway. The old one was about shot. Wouldn't have lasted through the winter."

Doing a slow burn, Doe paid his bill and drove away with his chirp. Several blocks away he saw another garage. He was determined to get rid of the squeak. It had gotten to be a sort of personal thing now, as if the car were hecking him. He drove into the second garage.

"Ah, a birdie," said a mechanic as Doc let the motor idle. "Yes," Doc said grimly, "a birdie—a squeak —a chirp—but what is it?"

"What you need, mister," said the mechanic, "is a new water pump."

"I do?" Doc raised his eyebrows.

"Yes," the man repeated, "a new pump. The bearing's shot on that one. No use trying to fix it. Cost more than a new one."

#### Another New Pump?

"You make up your mind in a hurry, don't you?" Doc asked.

"Well, I got ears," he answered. He raised the hood and turned to Doc in surprise.

"I had that pump put on less than an hour ago," Doe told him. "Guess again."

"If it's not the pump, it must be the fan," the man said. "Ever try lubricating it?"

"No," Doc snapped. "You try."

The mechanic oiled the fan bearing but the chirp didn't stop.

"Now what is it?" Doc asked.

"It must be the fan belt," the mechanic said. "Watch this." He squirted powdered graphite on the belt. The birdie continued. He squirted more graphite. The squeak went on and the fan belt began to slip.

"Got any more suggestions?" Doe asked.

"Yeah," said the mechanic. "You need a new fan belt."

"How much?"

"Dollar seventy-five."

"Put it on," Doe told him.

It was the same story when the new belt was installed and the engine started, Doe's birdie was still on active duty.

"Can you think of anything else?" Doc asked. "Would you like to put in a new engine?"

"Well, I'll tell you. Maybe . . . "

"No," Doc said firmly. "I'll tell you and without a maybe. I've had enough," He paid the bill, slammed the car in goar, and roared out of the garage.

A few blocks away, he saw Mandy. She was leaving a grocery store. Doc and the squeak pulled up to the curb.

"Hear you still have that rare bird," Mandy

said

"I've been to two garages," Doc replied, opening the door for her. "Get in. I'll drive you and the groceries home."

"Did you try the Model Garage?" she asked.

"No," he answered, "but the two I did try didn't have the cure. The diagnosis is free but you pay for the remedy, even if it's the wrong remedy."



"You sound like a doctor's patient," she laughed. "Try the Model Garage. Father swears by Gus Wilson."

"The way I feel now," Doc told her, "there isn't a mechanic in town I wouldn't swear at."

"Go on," Mandy urged. "Try the Model Garage. Remember, I'm still debating whether I want to go to the movies if that nasty little bird tags along." She was smiling as he left her at her home.

When Doc drove into the Model Garage shop, Stan Hicks was checking the water in the batteries on the charge rack. He looked up and grinned.

#### Doe Himself Has the Cure

"Don't tell me what's wrong," Stan said.

"You need a new water pump."

"Look," Doe began, fast running out of temper. "I'm going to tell you. I don't need a new pump. The fan bearing doesn't need greasing. I don't need a new fan belt. But what I do need is a mechanic who has enough brains to stop that chirp instead of sticking me with a lot of new parts I don't need."

"Now wait a minute," Stan said, taken aback by the outburst. "You're that new doc-

tor-Doctor Rhodes, aren't you?"

"That's right," Doe snapped, "but what's

that got to do with this squeak?"

"When patients come to you, do you tell them what's wrong, or do they tell you?" Stan asked.

"What goes on?" Gus asked, stepping over from his bench.

Dr. Rhodes told him about the other two garages, what they did, and how much the tariff had been. Gus listened patiently until Doc had finished.

"Just selling parts isn't our business," Gus said. "We correct what's wrong or it's no sale."

"You're the first one I've heard say that,"

Doc grinned.

"All right," Gus said, "start the engine."
He listened a moment and then added: "It's
a fact that a chirp like that very often is the
fan or pump. But I'm glad to know it's neither

in this case. Simplifies the job of diagnosis."

Gus listened to the squeak as the engine idled. He decided the sound wasn't coming from the front of the engine—by the pump or fan—but farther back.

"It might be the fuel pump," Gus said, "but it might be here. Cut the ignition."

Gus snapped off the distributor cap and then turned to the doctor.

"I think," he told Doc, "that you've got the cure for this squeak right there in your little black bag."

"What do you mean?" Doc reached for his

bag on the front seat.

"Got a tube of petroleum jelly?"

The doctor opened his bag and handed. Gus the tube. Gus pulled off the distributor rotor and dabbed a thin film of the jelly on the cam. He replaced the rotor and snapped the cap back in place.

"Start the engine," Gus said.

This time, when the engine idled, there was no squeak.

"That's wonderfull" Doc grinned.

"I wouldn't say so," Gus chuckled. He cut the ignition and removed the cap again. "See that little fiber block on the breaker arm that bears against the cam? When the cam's bone dry, the block makes a chirping sound at low speeds. When the engine revs up, the cam spins too fast to let it chirp. Not a good idea to oil it. Spinning around, it might throw oil around inside the distributor and foul the points."

"It still seems wonderful to me," Doc said, "The way you located it so quickly. How

much do I owe you?"

"The way I figure it," Gus grinned, "your petroleum jelly plus half a minute of my time add up to nothing at all."

Doe grinned back. "Thanks a lot. You may not know it, but I think you've just made a

lifetime customer.

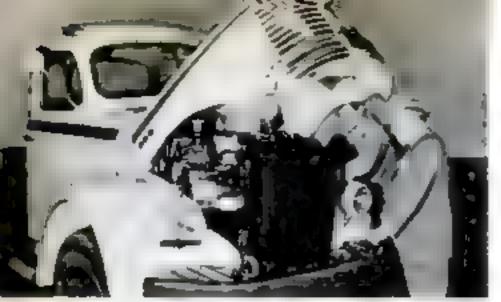
"That's the kind we're always looking for," Cus told him.

As Doc drove out of the garage, Stanturned to Gus. "I sure got off on the wrong

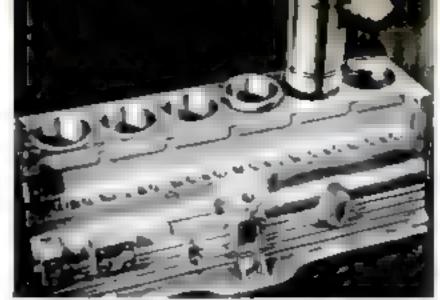
foot with that guy," he said.

"So I noticed," Gus answered. "You know, Stan, a good garageman is like a good doctor. One of the most valuable things he offers his customers is a listening ear. Talking about their car troubles makes the folks who foot the bills feel a little better. And sometimes, listening to them saves a mechanic from pulling a boner."

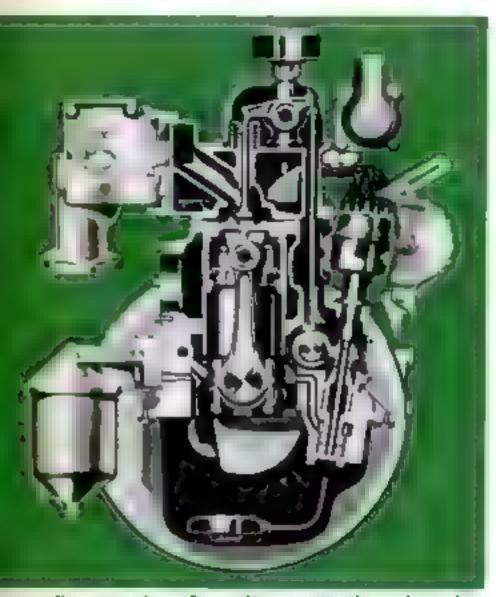
"From now on," Stan said, "I'm known around here as The Ear."



Hood swings up from the bumper line on Reo's new trucks to make engine more accessible. Engine has 6 cylinders and overhead valves.



Cylinder alcoves are easily replaced without special tools. An overlapping block gasket and rubber seals at bottom keep them watertight.



Cross section of new Reo engine shows how the sleeves fit in the block. The intake mamfold is east as a unit with the cylinder head.

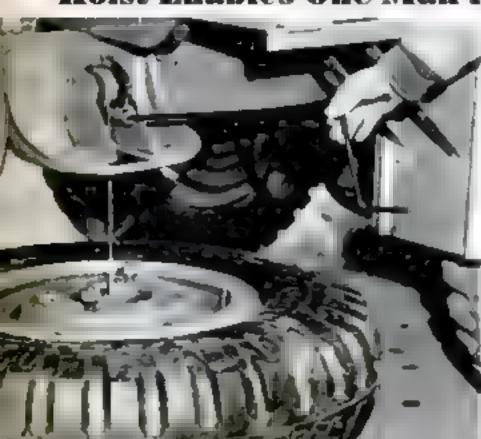
## Reo Adopts Removable Cylinder Sleeves

RENEWABLE cylinder sleeves of the "wet" type are used in a new heavy-duty gasoline engine engineered by Reo Motors, Inc., for its big trailer trucks. This means that cooling water comes in direct contact with the outer surface of the sleeves.

Adoption of a cylinder of this type offers truckers two advantages. When an overhaul is due, sleeve and piston assemblies can be replaced, producing what amounts to a new engine. While the engine is in operation, the cooling water can do a better job of heat removal because the sleeves are of uniform thickness. In contrast, conventional solid engine blocks have uneven surfaces on the water-jacket side of the cylinder wall.

Called the Gold Comet<sup>®</sup>, the 331-cu. in. engine develops 140 hp. at 3,200 r p.m. The engine is "square"—that is, the bore and stroke are equal, both 4%".

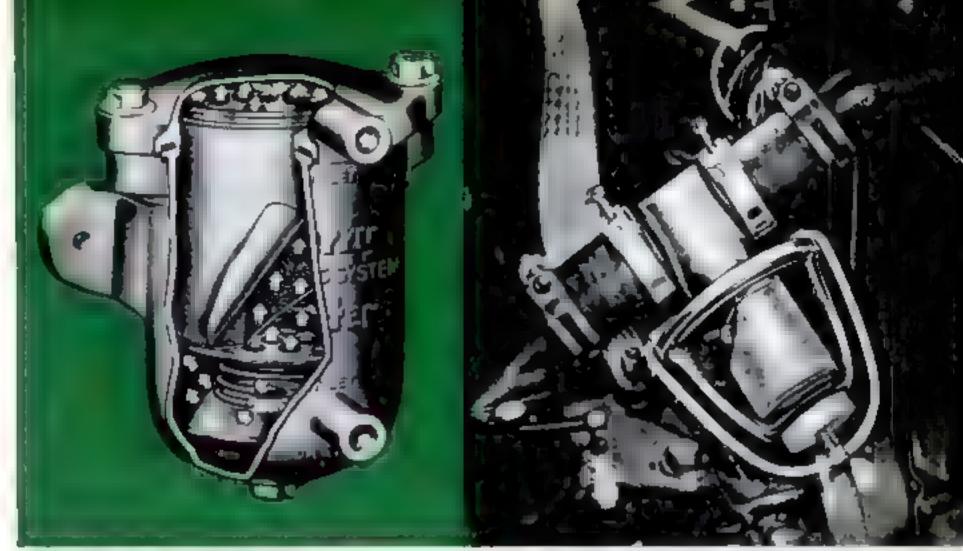
#### Hoist Enables One Man to Handle 225-lb. Spare



This spare-wheel hoist is located under the frame of a new 2%-ton military truck that Studebaker has submitted to the Government for trial. Operated by a removable crank, the hoist permits one man to raise the 225-lb. wheel and tire into position for mounting on the carrier.

The new truck has six-wheel drive. An undergeared front axle, coupled with a free-wheeling clutch, automatically controls the six-wheel drive on soft or wet ground. All axles are double reduction, with a straight-line drive from three propeller shafts.

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Perry Cooling System Fifter, left, and the Mota Gard, right, remove sludge and other foreign

matter from cooling systems, preventing overheating that can lead to expensive repair bills.

## Filters Clean Radiator Coolant

Much of the trouble caused by engine overheating can be eliminated with one of these new filters in the cooling system. The Perry Cooling System Filter®, made by Spark-O-Liner Corp., Minneapolis, contains a chemically activated element that softens and

cleans the water. Vulcan Mfg. Co., Inc., Winona, Minn., makes the Mota Gard® that removes sludge, grease, and scale. When Mota Gard is filled, a bypass automatically openssignaled by a red ball in the filter—to let the water continue to circulate.

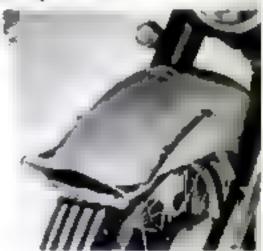
#### Jack Made of Cast Aluminum



This transmission jack for repair shops, made by Accurate Parts Mfg. Co., Cleveland, is of cast aluminum with a threaded steel spindle. It weighs 7% lb. and has a lifting capacity of 500 lb. The overall lift is 7" from a low limit of 13%". It's mounted on subber-tired wheels.

#### **Bumper for Motorcycles**

Manufactures by Harley-Davidson Motor Company, of Milwaukee, Wisconsin, a chrome-plated steel front bumper for motorcycles combines utilitarian value with a decorative, stream-lined appearance.



#### Theftproofing Tests Given Rear Compartments

Engineers of the Fisher Body Division, General Motors Corp., in attempts to make the rear compartments of their new models as theftproof as is practical, are using a series of jacks and gauges in stress tests. In the photo at right, the jack on the left pushes down, the one in the center is stationary, and the one on the right pushes up. Gauges are used to measure the amount of deflection of the lid under various pressures.

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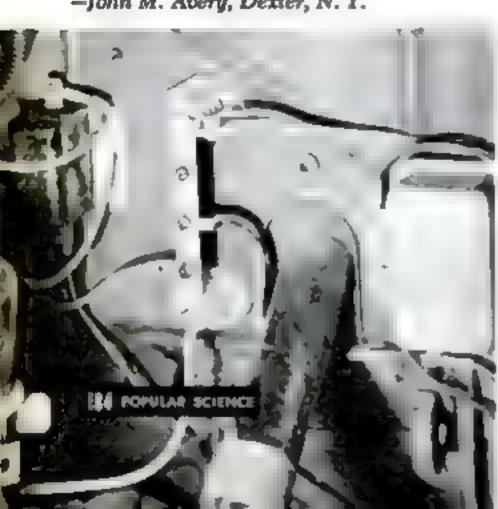




#### Rewiring Job Simplified

When adding lights or horn relays to the wiring system of an old car, a terminal strip on the firewall simplifies connections. The metal strip shown in the photo below is K" by K". It's tapped for connections and mounted near the steering column on two standoff insulators. The lower wire is connected to the starter terminal; the upper wire to the ammeter. In this hookup, the other wires run to the headlights and horn relay. The unused screw is for a possible additional connection.

—John M. Avery, Dexter, N. Y.



#### Motorcycle Drive Chains Need Exact Adjustment

Darve chains on motorcycles shouldn't be so loose that they slap other parts, nor so tight as to have no free play. There is no bet-



ter way of inviting a broken chain on the road. In adjusting a chain, first turn the wheel to find the tight spot (used chains almost always run tighter at one point on the sprocket). At this setting, adjust to leave about %" up and down movement midway between the sprockets, as at left.

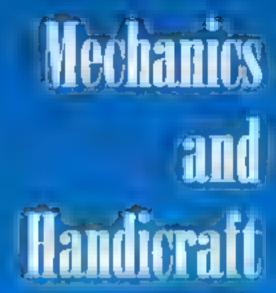
It's a good idea to inspect the chain once a week and make any required adjustment or repair. A damaged link can be replaced with the chain-repair tool seen above.

Remove the chain occasionally, soak and wash it in kerosene, and hang up to allow the kerosene to drain off. Then swish it around in a pan of light engine oil, or grease beated to that consistency, until the lubricant has worked into all inside parts. Wipe off excess oil and allow to drain.

#### Tent Carried on Auto Top

Comportable sleeping accommodations with such refinements as air mattresses, screened windows, and electric lights are incorporated in this auto-top sleeper. The unit, designed by Robert O. Bickel and Homer Carley, Jr., of Cedar Rapids, Ia., can be opened or collapsed for traveling in a couple of minutes. The platform is 1' deep, 5' wide, 10' long. There's 4' 10" of headroom in the tent. In driving tests, the designers hit 90 m.p.h. with the sleeper folded and 85 m.p.h. with it opened to full height.





One-Cylinder Midget Racers

How to Model Contour Maps

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Machining a 2-Hp. Engine

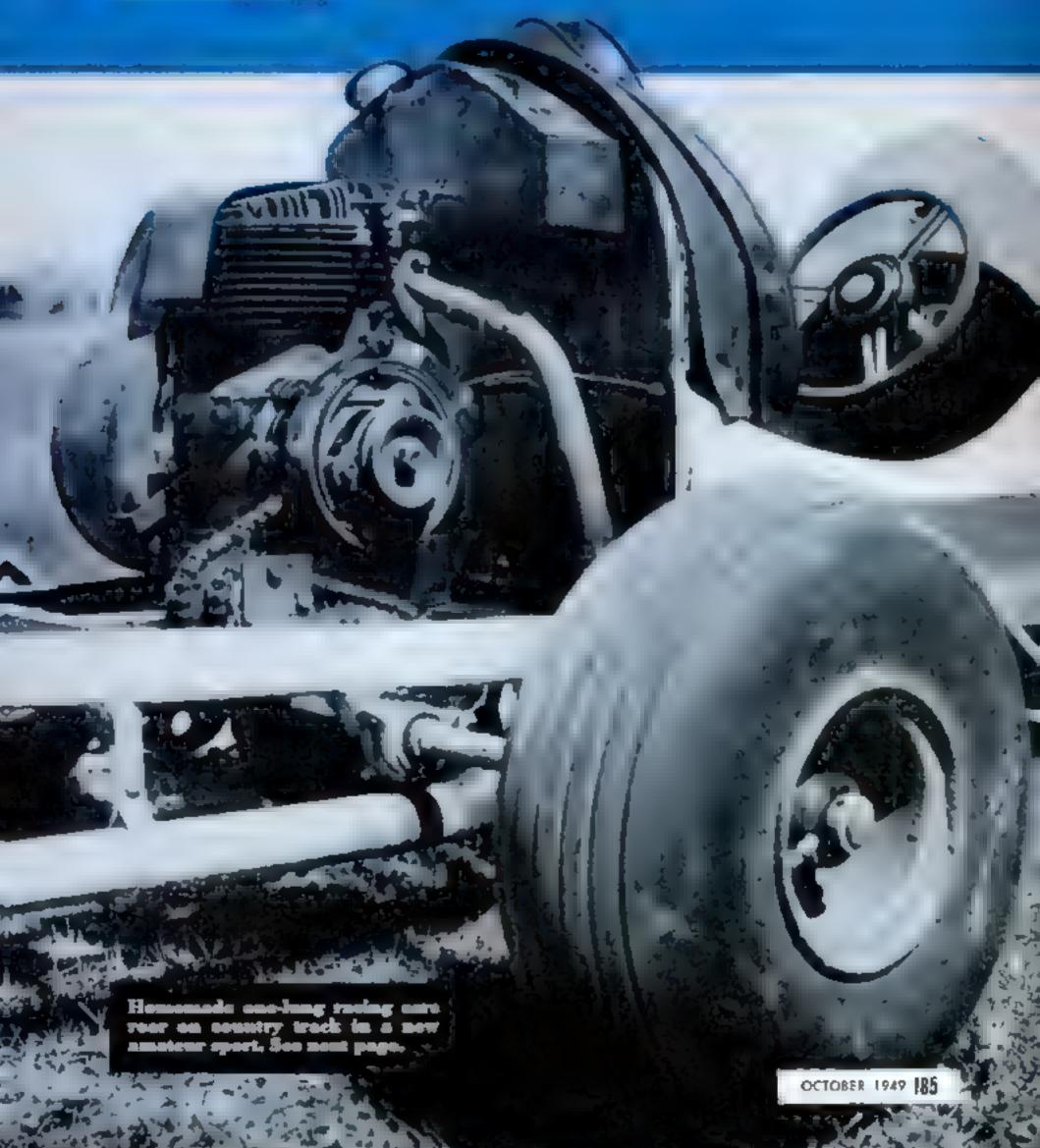
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Print Your Photos to Last

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Substituting Radio Parts

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Coming out of a tight turn, Eulauk car has a good lead over Howard's. Note latter's wheel tilt.

Indiana group builds and races tiny "micromidget" speedsters in sport started by article published in PS.

#### By Stewart Rouse

Photos by Bill Mickler.

It's SOME evening you should happen to be fiving over the Indiana corn belt a bright patch of light in the darkness might witch your eve. Circling low you see a language track, packed into the feed for between a farmhouse and its barns. An algang stand strangs of overhead lights, and lines of spec-

speedway. But any notion you're circling a conventional race track disappears as you see the drivers up-end their little cars like whicell arrows and tripable them out on the track for a race. What you're seeing is the regular weekly incert of the 'Bushville Micromidget Racers."

How did this farm-yard speedway get its start?

Last winter a Poetic vic Science anticle cilled. Engineering Your Own Midget Car'. PS. Dec. 45, p. 176. caught the eye of Lewis Eubank, operator of the Rushville.

Are view from the writer's plane, showing Davison feed lot converted to "micromidget" track.





Car on grass has spun out and been lapped. A helper is pulling on the engine-starting rope.

(Ind.) Airport, Following the article closely, he put together his car in about six weeks' spare time. Practicing on the airport turf, Eubank found that the little speedster would corner, skid, and spin like a full-size racing car. Others in the airport "hangar gang tried it out, and in short order five or six more cars were under construction. Lawrence Davison, a farmer flyer, volunteered to build an eighth-mile track in a feed lot on his farm. Surfaced with oiled dirt, the track was built with farm machinery and measures about 150' by 295'. Spectators watch from their cars outside the fence.

To give the group necessary unity, the Rushville Micromidget Racers Club was formed, officers elected, and car specifications established. The club now has 16 members, whose ages range from 22 to 45. They include farmers, salesmen, mechanics, and retail-store owners. The cars are required to have a tread (width) of not less than 40" nor more than 48". Engines are limited to a piston displacement of 15 cu. in for L-head 4-cycle power plants; 15 cu. in, for overhead-valve 4-cycle engines; 11 cu in, for overhead-valves and twin overhead cams, and 75 cu in, for 2-cycle jobs.

Extreme smallness of the racers is emphasized when they're seen along-ide conventional car,





Smooth engine housing on Harold Stark's car, above, was made by welding together rear left and rear right auto fenders along a centerline. Rope-starting drum extends through housing.

Hood hold-down straps on Stark car were once dog collars. The front galle is framed by an oval auto-headlight rim, and the transverse front spring came from an old farm-wagon seat.

Since I was very interested\* in these subminiature racers, I persuaded Bill Mickler, official photographer for the Indianapolis Speedway, to come out and photograph the micromidgets. After Bill had snapped the accompanying pictures, he volunteered to try out one of the little cars. Starting out cautiously, he was soon broadsiding the turns in fine style. Inevitably the hangar gang thought it would be fine if I tried one out too, and before I could protest effectively, I found myself fitted into a micromidget\* and picking up speed fast. Bill kept lapping me like a cannonball, throwing up dirt in my face.

At first the track seemed smooth, but as we began to roll I found it took everything I had at the wheel and throttle to keep the roaring little car under control. When I finally managed to stay up with Bill, the two cars seemed to float along, apparently stationary, while the track, fenceposts, and onlookers revolved turntable-fashion past us. It became very clear to me that handling these cars in competition is far from kids' stuff. Instead, it's a real test of driving skill, judgment, and nerve.

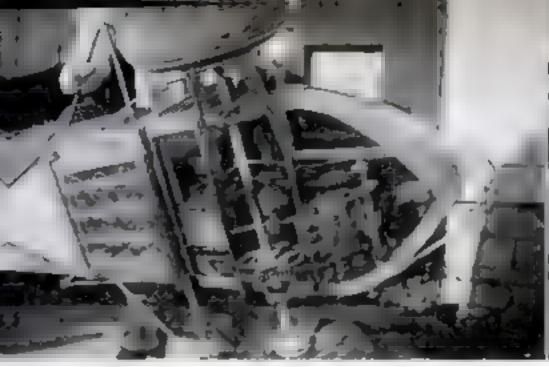
Considering the size of their engines (from 4 to 7 hp), the performance of these 200-to 300-lb. cars is astonishingly good. Top speeds on a level, windless highway are better than 50 m.p.h. On the tiny track with its short straightaways and 180° turns they make a full lap every 16 or 18 seconds. This figures out under 30 m.p.h., but when you're pounding along inches off the dirt, it feels like three times that.

The first step in building a car is locating an engine. Burk Jaggers, president of the \*Stewart Rouse, water of this article, collaborated on and Matrated Engineering Your Own Midget Car."-Ed. \*\*Rouse is 6 4", and probably still growing.-Ed.

club, picked a Harley-Davison 125 2-cycle engine to power his racer. Larry Davison and Harold Stark, also a farmer, chose Wisconsin 4-cycle jobs, model AKN. Most of the others used Cushman motor-scooter engines. For chassis side members, most builders used the side rails of old beds, commonly 1%" by 2" or 1%" by 1%" steel angle. The only departures from this were Jaggers' use of 1" by 2" channel steel, and welded aircraft tubing in the case of the Davison car.

For the arches and trusswork needed to support the steering column, hood, and seat back, preferred materials are X" o.d. steel tubing, X" steel rod, or angle stock, with most joints brazed or welded. Rear axles are the straight-through type, made of 1" or 1%" steel shafting, and running in pillowblock bearings on the frame. Usually the left wheel is fitted with roller bearings to turn free on the shaft and the right or drive wheel is splined to the shaft. One car has an Austin rear axle, complete with differential. Wheels chosen include 4 by 8 wheelbarrow wheels, 4 by 8 and 6 by 6 motor-scooter wheels, and plane wheels from Cubs and Aeroneas.

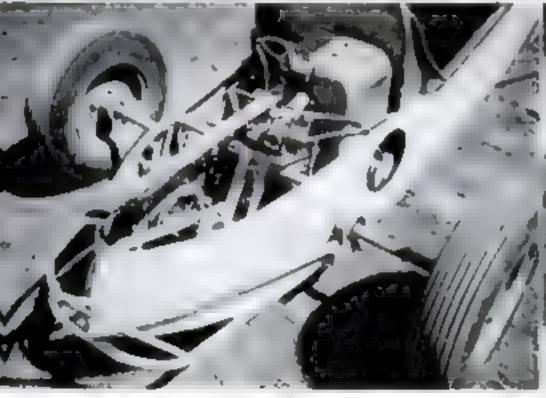
Front-end suspensions, copied from professional midget race cars, use a steel shaft as front axle with steering knuckles at the ends. Knuckles are designed to give correct wheel camber. Steering arms are connected by tie rods adjusted for toe-in. Spring shackles on the ends of the axles connect them to two-leaf transverse springs, clamped Ford-fashion to a frame cross member. Castor or lean-back of the axle is sometimes provided by a wedge shim between spring and frame. Steel radius rods running back to the side of the chassis are commonly employed. One car is fitted with triangular



I nderview of the same car shows how the frame was curved by rate range because and winding the honges of steel angle stock. Note the coal sent springs and the steel wheel guards



Power train of the Stark car is from Wisconsia engine to Mercury clate. Then you che not an Instant more well transmission and to by a second character role and to by 6 drive when



Compact and light, the engine compartment of the Davison Dollan car contains a Wisconsin cugua and jackshilt in nor. Note the large our jecks saft and pull weblock bearing to rayle



Steered by a plane wheel, Divisite Dibbat, car bus trin lines. Steering rabie is lead to end of the rod by a pariett time scale. But with mirrors on a ocly in para burns.

Davison-Dobbin car has welded tubular frame, weighs only 225 lb., and holds the lap record.





Arrplane influence of Eubank car shows in use I Acre ia a waces in front Cub wheels in back plane control wheel in I Cub control stick as a brake lever. Latter pumps a master evander

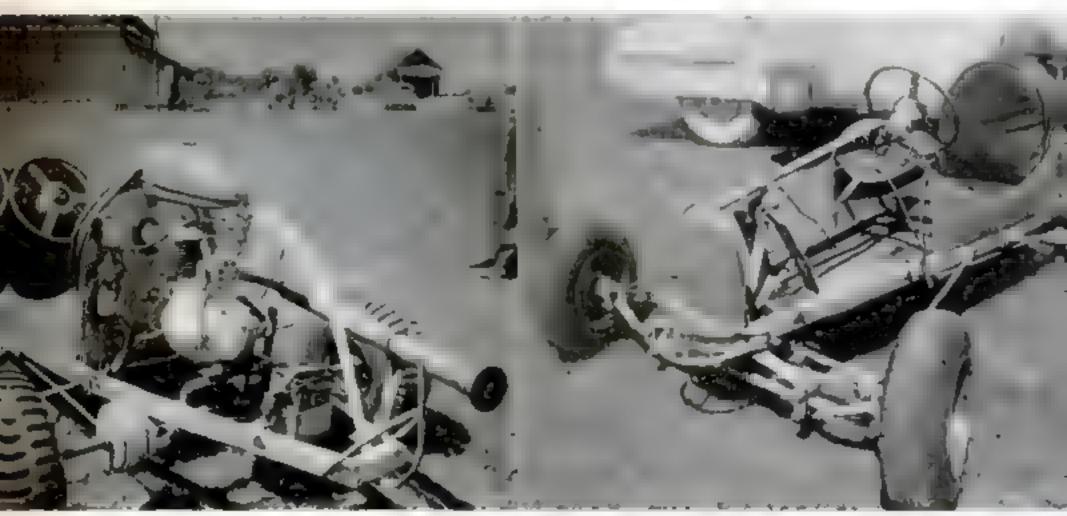
to apply Cub hydrauhe brake on rear axle. End of the jackshaft can be seen under tail. The engine is from a Cushman motor seor ter and has been fitted with oversize valves from a Pontiac

steel guards in front of the rear wheels to prevent hooking wheels with other cars in crowded turns and monps

Drum-and-cable steering systems are mainly used, though Jaggers cut down a Ford Model-T gear for his car. Since the streng columns measure 1" to 1% in diameter, they serve as drums, being wrapped with about seven turns of 5" steel

aircraft control cable and anchored with a clip on the middle turn. The cable generally runs through turnbuckles to lugs welded on the ends of the tie rod. Steering wheels are either cut-down auto wheels or light weight control wheels from planes

Brakes, all hand-lever operated, include mechanical brakes taken from scooters, hy drauhe brakes from planes, and in one

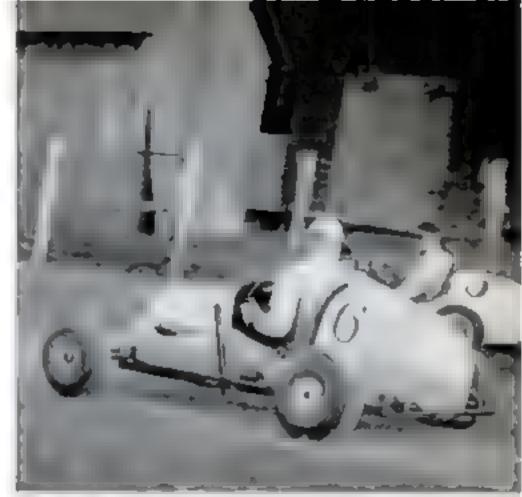


Driven by a motorcycle engine, the Juggers car has a small for to conflexionder when engine is running but car is standing stall. The bug flaring tailpipe was originally a brass bedpost

Cut-down auto steering gear guides Juggers our. The two large pedals that stradule steering column control the clutch and throttle. The lever with knob on top applies a motor-scooter brake



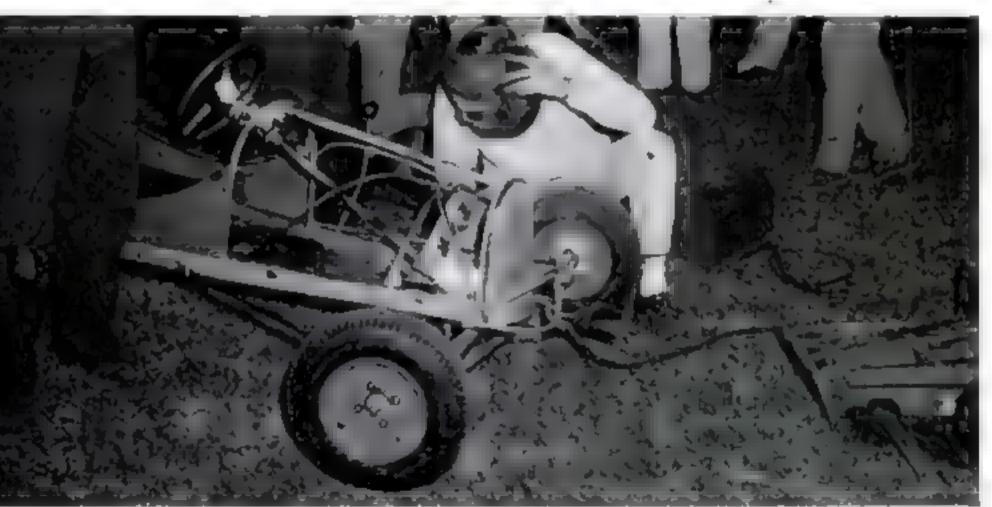
A standard Cushman engine powers the Howard ear which has ingenious ratchet system that permits both rear wheels to drive on the straight aways but lets the left one go slower on turns



Camera catches a tense moment here the drive wheel on No. 6 goes flat at full speed and driver fights start of a spin. Car No. 5 swings wide to pass in clear. No. 6 skidded to safe stop

instance a homemade band brake. Clutches of the centrifugal type are used with the Cushman and Wisconsin engines; the car with a motorcycle engine has a built-in clutch and transmission. For most cars a primary chain drive to a jackshaft and a final chain drive to the axle has proved satisfactory, though several cars use a selective gearbox.

Bodies on these micromidgets are made of cut-apart and welded auto fenders and hoods. Judicious piecing of fenders makes it possible to get the compound curves involved in the tail and cowl. Leatherette upholstery, plastic windshields, and hood hold-downs made from dog collars are the finishing touches on some cars. Most of them sport a fine sprayed paint job.



Fixing 'em on the opot is no trick when you've built them. Here Burk Jaggers is using a portable are welder on the infield grass between races. Though practically all cars in the club

have had minor or major crackups, no driver has been hurt. Wide tread, sturdy construction, comparatively low speeds, and driving skill help account for this good safety record.



Wagon-wheel spokes and a w lacisoned plack wire the raw mater is for the low beach. If was accounted to retain the unesen

edge to selp as the piece tre Longmide lock I front to that are from the slaps of early critisms. Natural stands of great

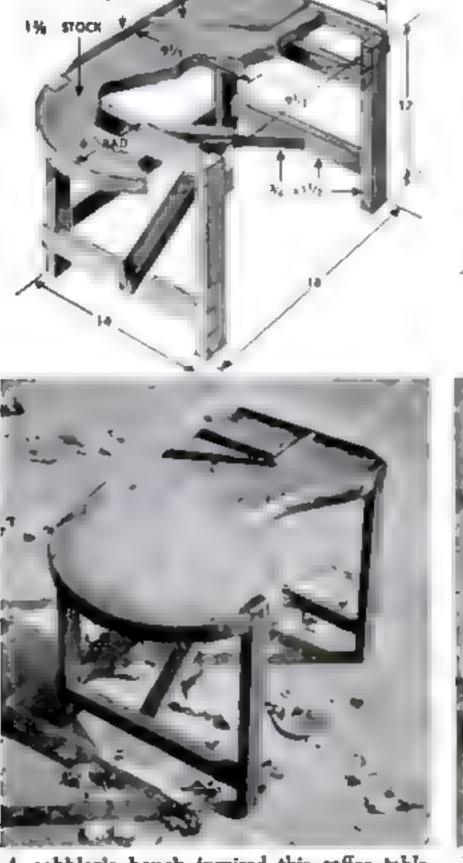
# Three Antique Benches

WOOD salvaged from an old building, perhaps a barn, offers ideal material for building furniture of this kind. A weathered appearance makes no difference as long as there's solid wood underneath. Planed down and given a natural finish, such wood imparts to simple furniture an air of antiquity that you'd never get otherwise. A few worm holes help this idea along.

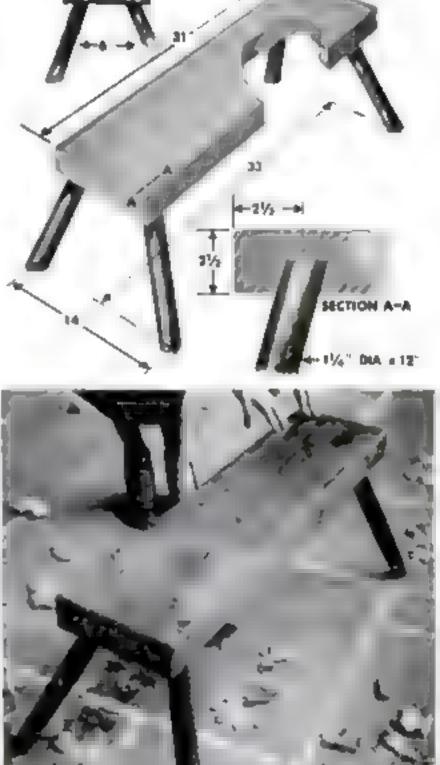
For the bench tops, it's more convenient to have full-width stock, although you can of course glue up separate pieces. Don't let open knotholes or other openings scare you away. You can fill these with plugs cut out of scrap from the same stock.

Because of their lowness, two of the benches shown are most apt to find use as stools or odds-and-ends tables beside chairs, indoors or out. The other is high enough to win a job as a coffee table

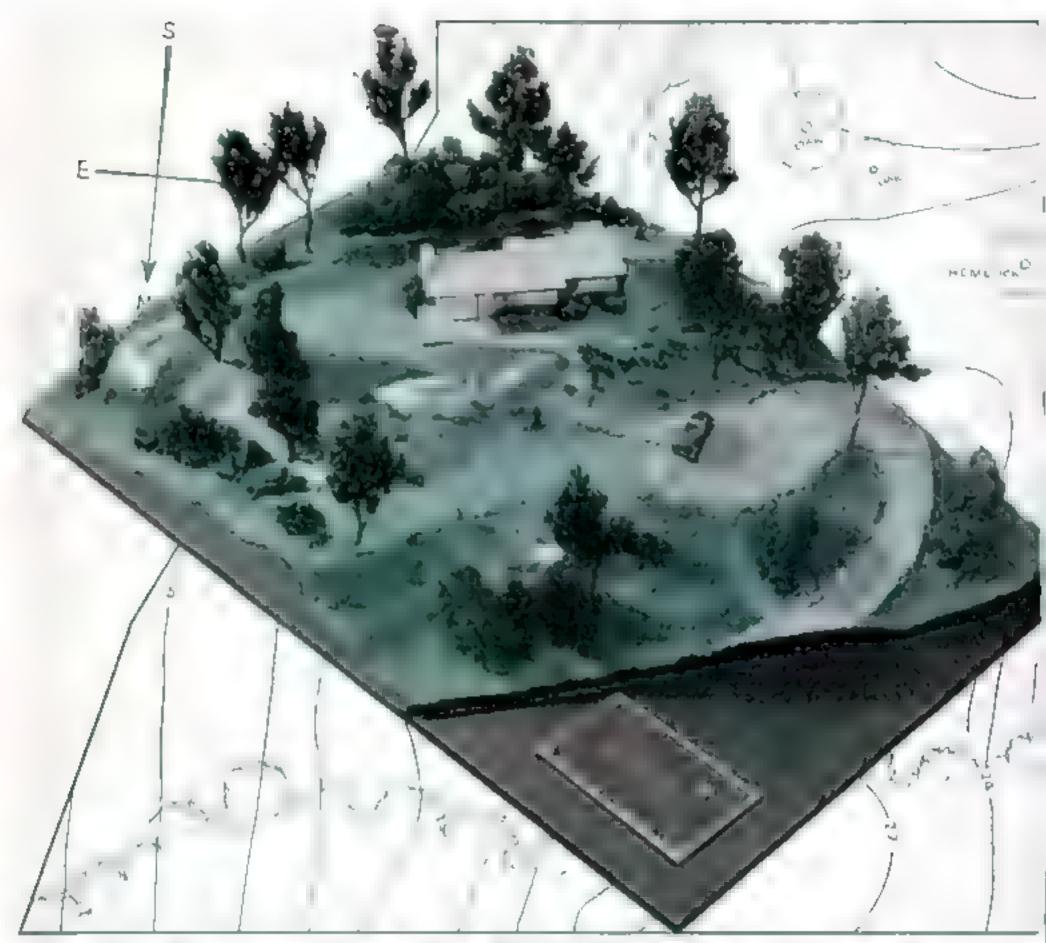
The two low benches require no screws just careful fitting and glue. If screws are used in the cobbler's bench, countersink them and plug with dowels.



A cobbler's bench inspired this coffee table. Notice the diagonal bracing. The short piece, at the near end, butts against the longer one.



Long enough to seat two, this sturdy bench was made from a billet of used lumber. Note that previous boles in the plank were filled.



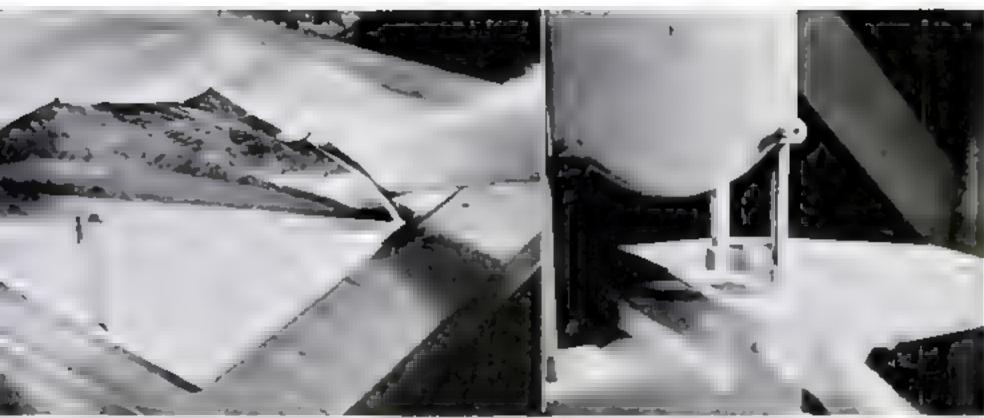
Picture your dream house in three dimensions to make best use of the land you have. A real

help in planning, the model can eventually be used as an unusual decoration in the home.

# How to Model Your Contour Map By Harry Walton

It TAKES practice to read a contour map, but everyone can "read" a terrain model at a glance. The three-dimensional quality of a model makes it vastly superior to a sheet of paper for planning home sites, driveways, or other improvements on your property. Such a model is fun to build, too. After it has served its original purpose, it makes an unusual display piece.

You can survey land contours yourself with a few simple tools (PS, Sept. '49, page 180). The contour map resulting becomes a blueprint for your model. If the land is mainly level, you can model it by building up a plywood panel with clay or plaster. But if the ground is hilly, freehand modeling



Stick carbon paper, black side out, to the back of the map with subber cement. For each lift, draw two contour lines, the outer to cut it on, the inner to locate the next lift.

Bandsaw makes fast work of cutting out the lifts. A jigsaw would also serve. The map shown was built up of \$" plywood, Inside of lift is cut out to lighten total weight.



Base is a plywood panel. Here second lift is being attached; it is aligned with the second contour line on the first lift. Hole is band-sawed, the entrance kerf being filled with glue.

If base has any warp, clamp the high corners down on a true surface. Coat the joining surfaces of lifts with glue and nail the upper one down with brads. Note the hollow interior,

is wasteful and inaccurate. You should build on a core shaped to the contour lines of your map.

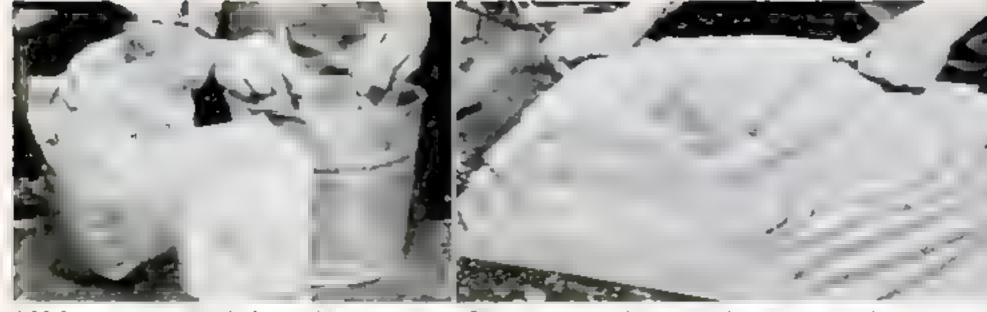
In drawing the map, you've probably picked a convenient scale that will be equally suitable for the model. A model of a 50' by 100' city lot to %" scale would be 18%" by 37%", a manageable size. If you're modeling a half acre, %" to the foot may be better.

Your scale, plus the contour intervals of your map, determines the thickness of the lavers, or lifts, of which the model is built. If the intervals are 3' and the scale is %"

to the foot, then X" fiber board or plywood will be suitable lift material.

When the lifts are assembled, they're a three-dimensional rendering of your contour map. To blend the contour lines, fill in the intervals with a modeling medium. Clay can be used but makes a heavy model. Lighter and equally permanent materials include powdered asbestos, sawdust, or wet newspaper pulp, mixed with plaster of Paris and animal glue or library paste.

Vinegar slows setting time and so gives you a chance to model the stuff. Nothing beats fingers for applying the mix.



Add I teaspoon animal glas ( ) caps were an 's cap vitor is 1 to 1 pt poster of Personal I to assess powers Max cold be cought to well and a cold be cought to well and a cold be constituted as a constitute of the constitute of the cold be constituted as a constitute of the constitu

Fingers are used to press the vax a wooler, base. Do, t point in tip described which should be but by exerted. Note I all the are to press the control of the latter of the press to press the control of the latter of the latter

Work the well at the edges, but den tover load he contour lines. Be sure the plaster is complete a day before any painting is long.

You can use oil paints on that house paints but avoid glossy plants and chariels. Poster parits are cherp way to use quick diving, and love a good flot finish. But color alone

preduces a feet attainst offset whereas large scale models like this a mand textural surfaces. Apply a secting cent of the ned point she has no variously and their a cent of that paint the color of the desired surface. While this is still tooky silt on a dived savidist editor grounds sand bridging gravit.



It's not too late, even after this hardens to corge details. Driving it was bull-lozed while

map was being moduler. To add it some plaster was scriped all some wated to be a tac bank.



Best imitations of big rocks are little rocks. Dampen them and set into wet mix, or bed them in plain plaster. Formula given soon becomes dry and crumbly, so mix small batches often.



Go out on location for last-minute detail modeling. Here, last touches are put on rock outcropping that represents, on the model, the rocky ledge extending into background.

or other material that will give the scale effect wanted. When the adhesive coat has dried, blow or brush away the excess.

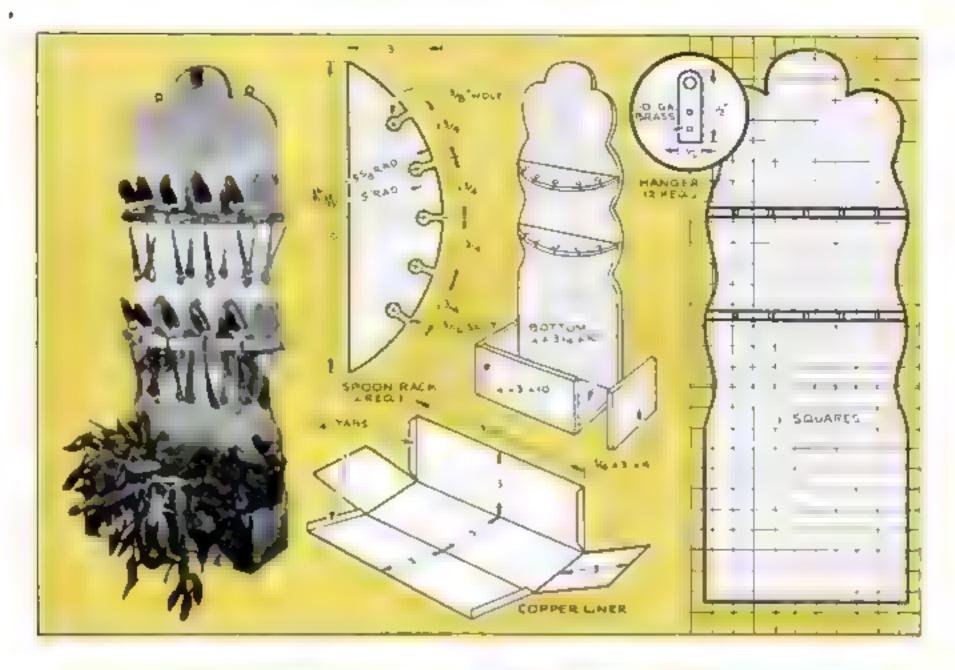
Rayon flock, which comes in many colors, is a versatile surfacing medium. Be careful, in applying the adhesive, not to cover rock outcroppings, except to represent moss.

Trees and shrubs can be bought from model-railroad supply houses. Sponge rubber, dyed green and torn (not cut) into shape with the fingers, makes realistic ones. Some types of trees must be built up out of wire (PS, May '44, page 161). Frayed rope cut short represents grasses.



Trees fit into holes drilled through plaster into plywood beneath. Shrubs are Norwegian

hehen moss, sold for model-railroad scenery. House is removable, built to same scale as map.



# Living-Room Planter Shows Off Spoons

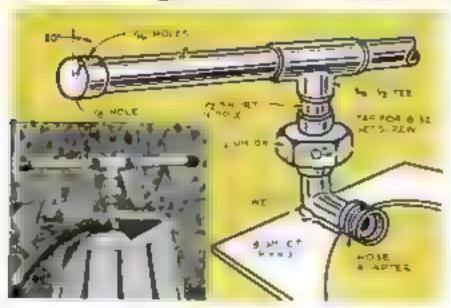
A TOUCH of green and a showplace for fine silver are combined in this planter. The rack shown was built of %" knotty pine. Other wood can be used to match your furniture.

Lay out the back, using the squares, and cut it to shape with a coping saw or on a jigsaw. Cut the two spoon holders to size and drill the %" holes. After the pieces are sawed and drilled, the notches are cut to the holes. Attach the spoon racks to the back

with glue and No. 4 finishing nails, driven in from the back and countersunk

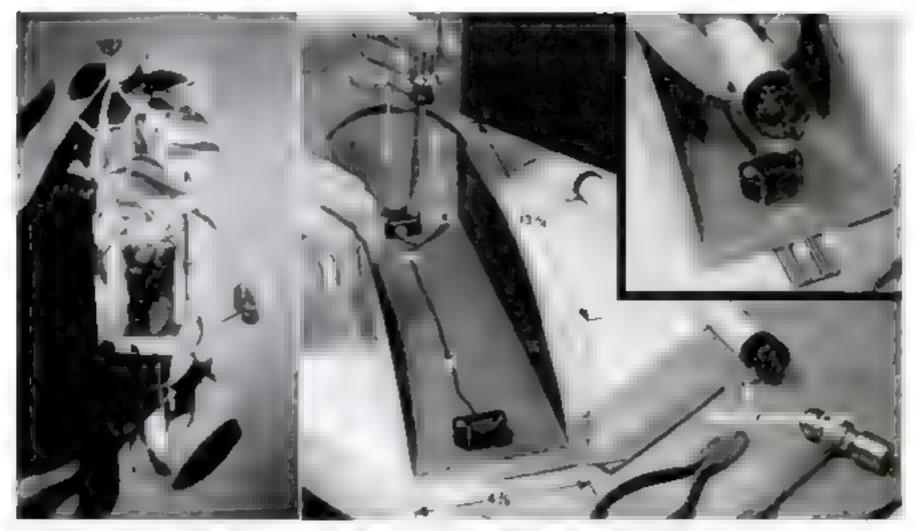
Assemble the wooden box and glue and brad it to the back. The copper liner comes next. Cut it to shape and fold up the ends and sides. To make straight, sharp bends, clamp a piece of scrap wood inside the bottom. Use another piece of scrap to force the tabs up 90°. Clamp the tabs in position and flow solder along the joints inside the liner. —Whitney K. Towers, Los Angeles.

#### Lawn Sprinkler Built of Standard Pipe Fittings



ONLY about \$2 worth of parts went into the heavy-duty sprinkler pictured at left. With six outlet holes in the long bar, it covers far more territory than the average sprinkler. The caps can be turned to raise or lower the end sprays, but the %" holes must be located at opposite sides at the two ends to effect rotation. To adjust, draw the union nut hand-tight and then just loosen until the bar turns freely. Lock it with the setscrew. Lubricate with cup or pump grease.—D. C. Van Alystyne, Beverly, N. I

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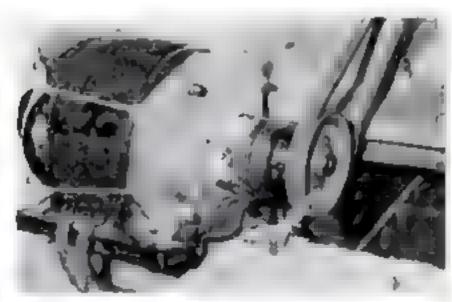


#### Old Scoop Makes Modern Electrified Sconce

Find an old-fashioned wooden grocer's scoop and it's only the work of an evening to convert it to an unusual wall sconce. The one pictured here was picked up in a second-hand shop. You can make one easily enough Use %" stock for bottom and back, %" stock for the sides, and attach a big file handle to carry out the scoop idea.

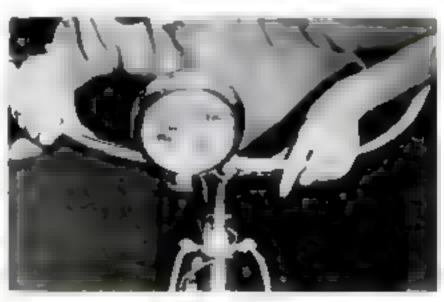
The light is a 40-watt Lumiline® lamp

made by General Electric. It looks like a fluorescent tube but it's an incandescent lamp. One of the fixtures has a canopy switch built into it. Screw the fixtures to the scoop and drill a 3/16" hole in one corner of the scoop for the wire. Split the cord, running one wire up the center of the scoop to the top fixture. Connect the other wire to the lower fixture.



#### Screen Keeps Motor Clean

Sawbust and chips may cause overheating and fouling of shop motors. Two pieces of window screening, cut to fit the end bells of the motor, will eateh much of this waste. Cut a center hole for the bearing and smaller holes for the acorn nuts. Dip the screen in light oil, drain well, and fasten it in place with string or fine wire as shown. The oil will help the screen catch dust.—John Pugh, Ilion, N. Y.



#### Scaled Headlight for Bikes

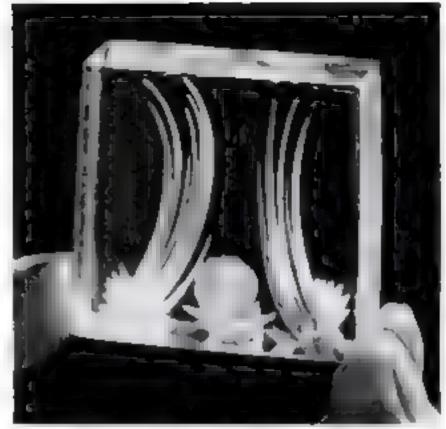
A junion edition of the one-piece, allglass, sealed headlamp used on autos now is being manufactured by General Electric for bicycles. The lamp, mounted on the handle bars or front fender, throws a beam pattern about 30' long and 5' wide. It's rated to draw % amp. at 5 volts and has a designed life of 100 hours. Either a generator that's designed for bicycles or a battery of the 5-volt hand-lantern type operates it.

# How to Drill Curves in Plastic

THE graceful curves in the plastic block pictured at right were drilled with an ordinary straight taper bit. Plastic memory—the characteristic of certain acrylics of reverting to original shape on reheating—is what changes the straight holes to curves.

First, cut and polish a block of acrylic. Heat it in an oven and squeeze it hard in a vise, C clamp, or laminating press (PS, Dec. '48, page 204). The more you flatten it, the more pronounced will be the curves.

After it has cooled, drill the holes. It's best to drill the lines you want curved near the edges of the block. The nearer the edges they're drilled, the more they'll curve. A pleasing pattern can be formed by drilling near the four corners.

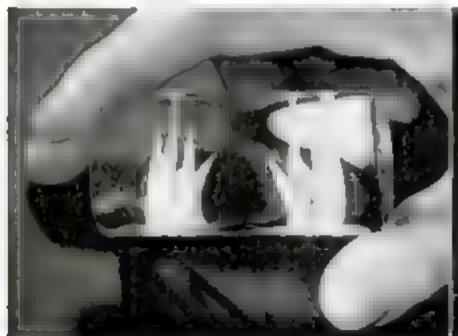


Curves combine with other internal carving to produce unusual effects. The carving may be dyed after block has resumed original form.

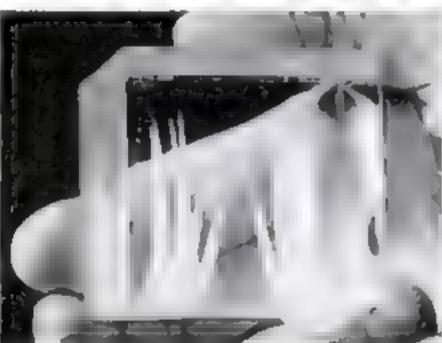
After drilling, put the block back in the oven-not in a press-and reheat until it has returned to its original shape. Do any floral or decorative carving after the block has resumed its shape. The carving then can be dyed.—M. J. Moch, Jamatca, N. Y.



At right is the original shape. Center shows it partially compressed. Final step is at left.



After compressing, plastic was allowed to cool, Holes, actually straight, look curved here due to optical distortion of bulged edges.



Finished block may need additional sanding and polishing to clean up surfaces that may have been scratched during work.

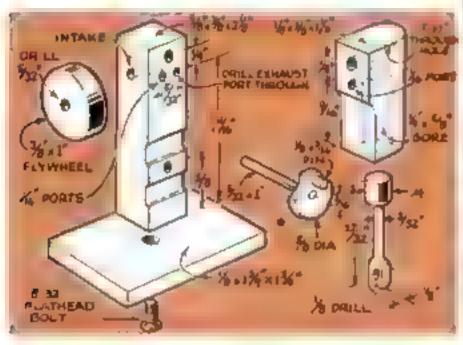
#### Midget Engine Has Few Parts

Desprie its small size, this model oscillating steam engine puffs along smartly. It requires no castings. To make it, you should have a lathe and drill press, but you might get along without the former by substituting an available small wheel or a gear for the turned flywheel.

Precise placement of the valve ports is essential. When the cylinder is on dead center, its single port must fall exactly between the intake and exhaust ports in the post—without overlapping either. The valve face should be ground in to prevent leakage, and the lower part of the cylinder re-

heved slightly to reduce friction.

For the cylinder, first drill the bore 15/64", then use a %" drill. Square the bottom of the bore by using a %" drill ground straight at the end. Use %" cold-rolled steel or drill rod for the piston, turning down the connecting rod and filing the boss. Drill the boss %". If you have no lathe, it's entirely possible to saw and file down the con rod.—Alfred Faux and A. Colding, Sault Ste. Marie, Ontario.







#### Fireplace Form Helps Amateur Masons Do the Job



Ir you are planning to build an outdoor fireplace, here's a way you can ease the job. Price Fireplace Heater & Tank Corp., Buffalo, N. Y., offers a steel form around which you can place any kind of exterior—stone, brick, or concrete.

The unit includes a removable steak grill, an adjustable grate, and variable draft. For winter storage, you can pull the entire assembly out of the masonry. Called the Fyro-Grill, the unit stands 22" high and measures 17" wide and 21%" deep. It sells for approximately \$20.



Combination bookcase is a big space saver in a small apartment. Unit includes room for a

typewriter and typing paper as well as books. Above, hinged support for leaf is screwed on.

### Bookcase Includes a Desk Shelf

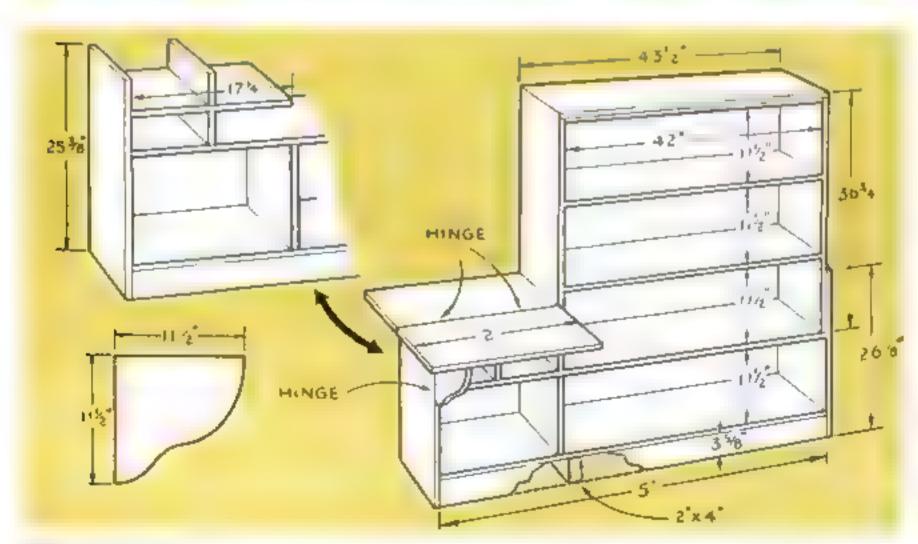
WRITING desk, typewriter stand, paper cabinet, and bookcase are all combined in this one unit. When the leaf is dropped, the cubbyholes for paper and envelopes are concealed and the top may be used as a radio table. I built this one in two sections for lightness in moving. Top, sides, and the two top shelves are one unit that fits onto the base,

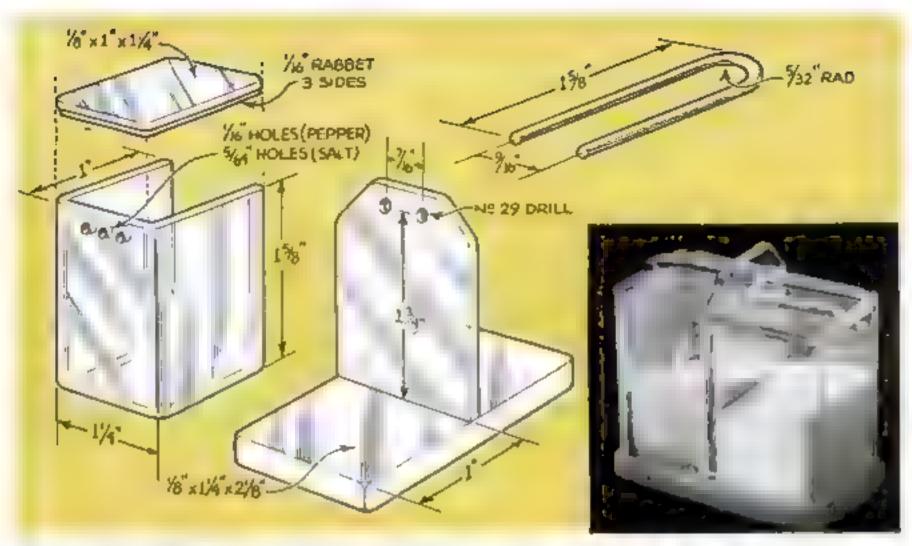
Most of the lumber used was 1" by 12". When dressed, this stock is about \$" by 11%". In building the base, you can insert as many two-by-fours as you want, depending on the

weight the lowest shelf will have to bear.

The uprights at each end are glued and screwed to the base. One upright supports the desk top; the other stabilizes the upper section of the bookease. The back boards are set inside the shelves for additional support. Two butt hinges join the leaf to the top. Another pair of butts is used to hinge the leaf support, which swings out of the way around the end when not in use.

Before the leaf and support are put on, the entire unit should be painted or varnished. —D. W. Brentlinger, Richmond, Calif.





#### Pepper Pot and Saltcellar Combined in Plastic

Thus neat little Plexiglas® package does the work of both a sult and pepper shaker. The rabbeted lids are held tightly by a removable keeper bent from %" bar stock.

Bend the sides around a balsa form block after heating the plastic in an oven. Wearing gloves, hold it in shape around the block until it cools. Bending causes slight bulges at the edges of the bends. File or sand these until you have a true surface.

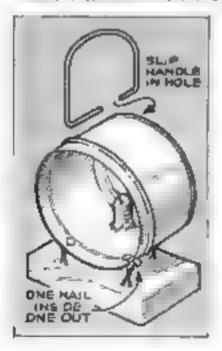
Pour a little ethylene dichloride into a saucer—just enough to cover the bottom—and soak the base of the centerpiece in it for about a minute. Spot the center on the base accurately by using the sides to locate

and square it. Let the center stand until it sets. Soak the side and bottom edges of the sides in the solvent. Do this by repeatedly dipping first one surface and then the other for about a minute. Set these in place and let them dry.

While the joints are drying, rabbet the lids. You can do this with a small router bit in a drill press, with a hand grinder locked solidly in a jig, or by careful filing. Fit the lids in place and lay out the holes for the keeper. The bottoms of these holes should be slightly below the tops of the lids. When pressed into place, the keeper will then hold the lids.—Frank Pars, Washington, D. C.

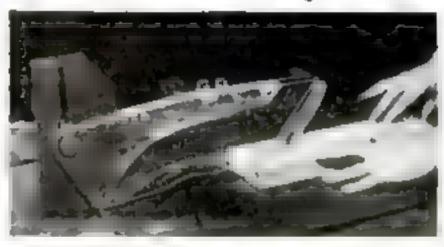
#### Lantern Made from Can

Even on windy nights the candle in this make-shift lantern won't blow out. As shown



in the sketch at left, see nails hold a coffee can to the base. Three of the nails pass through the can. The handle is a piece of stout wire that's bent to shape. One end fits in a hole in the rear of the can and the other end is turned under to hook below the front rim.—W. J. Spangler, San Francisco.

#### Saw Guard Is Transparent



MADE of Plexiglas® by the Laminated Sheet Products Corp., Boston, this guard covers the blade but permits the operator to view the work. It's for circular saws from 8" to 20" and comes in two sizes, one for stock up to 3" and the other for thicker.

## Floral Basket Lights the Table

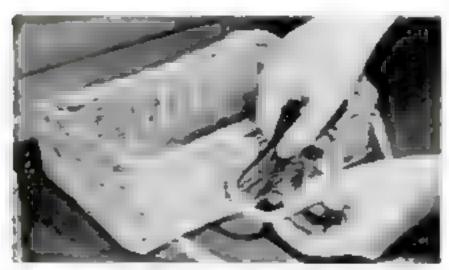
TWO 12" rulers, a small wicker basket, and a bread pan are the main parts of this illuminated flowerbox. Used as a center-piece or as an addition to an occasional table, the pair of 25-watt showcase bulbs throws a subdued light. The basket pictured here cost \$2. It measures 5%" by 7%" by 12". A bread pan that holds the soil just fits the bottom.

First step is to remove all excess parts—handles, hinges, and latch. The wiring runs up one of the rulers—or a wooden strip the same size—through a 9" section of metal curtain rod. Two small strips cut from a tin can clamp the rod to the ruler. Both rulers are painted yellow to match the basket.

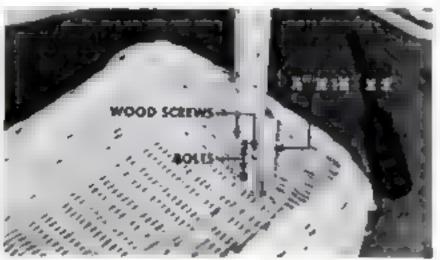
Machine screws hold the wooden blocks and rulers to the ends. Use washers under the heads of the screws on the outside of the basket. Otherwise, the heads may slip through the wicker when the nuts are tightened. Intermediate-size receptacles are



mounted on a wooden crosspiece. Two small angle brackets and machine screws through the wicker hold the crosspiece in the top. A small feed-through switch on the cord completes the wiring. Ivy, cactus, or philodendron will look well in the basket.—Arthur C. Miller, Manhattan, N.Y.



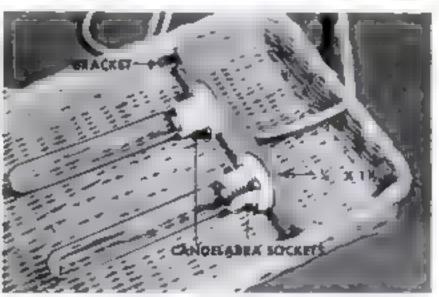
All unused parts such as hinges, clasps, and handle were removed by snipping the wicker bindings with wire cutters.



Rulers and small blocks of wood are fastened to sides of basket with machine screws. Heads of screws and washers are on outside of basket.



Lamp cord was passed through piece of metal curtain rod that was then clamped to ruler. Two 12" rulers support top of basket.



Two 25-watt showcase bulbs provide light. Sockets are mounted on wooden crosspiece that's held by angle brackets and screws.

## Lazy Susan Spins on Ball Bearing

NICELY balanced, this Lazy Susan whirls at the touch of your finger. Set into its base is a high-grade ball bearing I picked up in a war-surplus store for 75 cents. Supposedly, it came from a dismantled range finder. However, you can use any kind of bearing you happen to have on hand. If there's nothing better around, a roller skate wheel will serve adequately

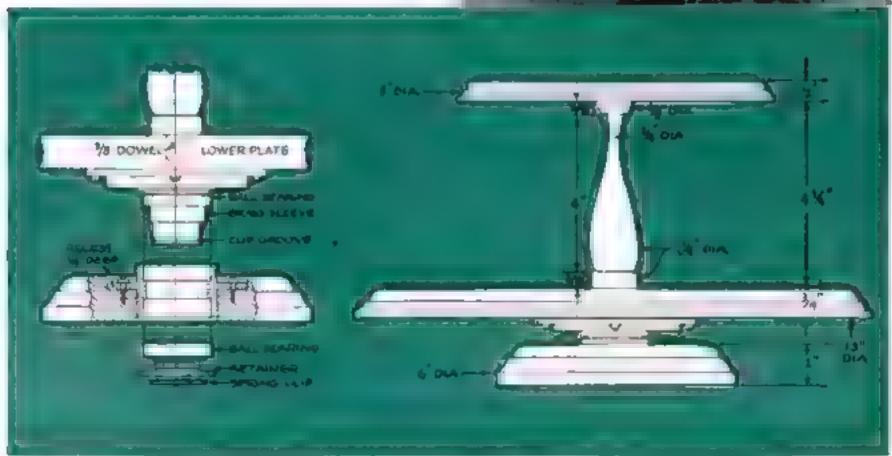
Wood of three different thicknesses was used for the table—1" for the base. X" for the lower plate, and \(\frac{\pi}{a}\)" for the upper. Chances are you'll have to glue up stock for the 13" lower plate. Rounded and smoothed on a lathe, this has a decorative edge turned on it, as does the 8" upper plate. The post that connects the two plates is turned with a short \(\frac{\pi}{a}\)" dowel on each end

The bearing was taken apart for mounting. After boring a hole through the wood base, I dished out a depression in the top face and seated the bearing wash

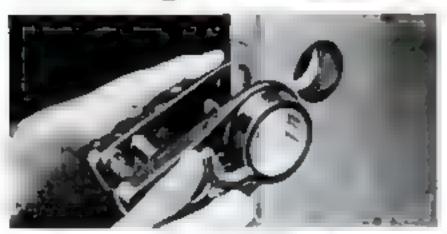
screws. The bearing shaft was screwed to the bottom of the lower plate.

Before final assembly, I gave the table a triple coat of diluted shellac, followed by wax.—Norbert Engels, South Bend, Ind.



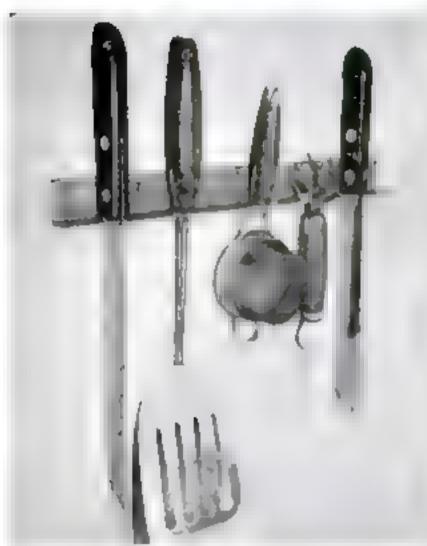


#### **Drill Jig Reduces Door-Lock Installation Time**



CLAMPED to a door, this drill jig is said to assure a perfect lock fit and to speed up installation. A product of Kwikset Locks, Inc., of Anaheim, Calif., it's designed especially for door locks made by this company. A spacing screw permits accurate adjustment on doors ranging from 1%" to 2" thick. Made chiefly of aluminum, the jig weighs 2% lb. It's priced at about \$4.

# Offbeat Jobs for Metal Holding



Kitchen utensil rack is a section of stair nosing. Hacksaw the slots in curved edge to take utensils, and then nail or screw to wall.

those shown here, your own needs undoubtedly will suggest others.

Aside from the zine lineleum binding that's been around for years, moldings now generally available are aluminum alloy or stainless steel. The former is a bit less expensive and is easier to work; the latter is stronger and can be soldered or brazed. A

THE metal moldings and strippings sold in most hardware stores have scores of

additional uses around the home. Besides

took you need.

Make 90° bends in L-shaped molding by first filing a V-notch in the flange. Curves can be bent freehand but it's usually best to bend them around a solid object of about the right radius. In designing complex projects, give some advance thought to assembly and what holes need to be drilled. Otherwise, you might find yourself in a situation where a bend prevents drilling. The moldings in sectional views below are aluminum alloy, made by R. D. Werner Co., Inc., New York City.—A. C. Miller, Manhattan, N. Y.

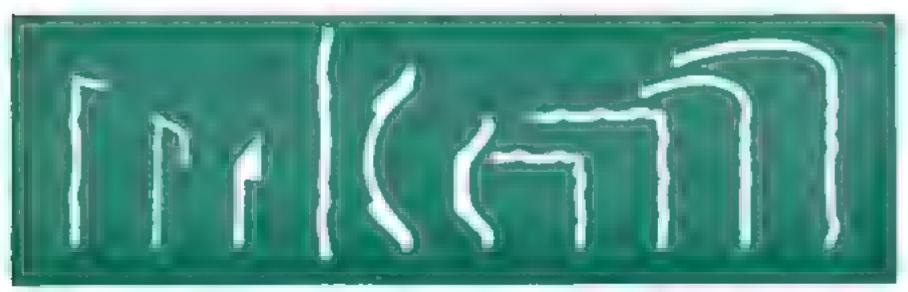
hacksaw, hand drill, and files are all the



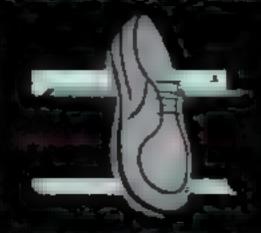
Bracket for wall lamp is bent of 1%" flat decorative strip. Socket is attached through a %" hole at the top of the straight section.



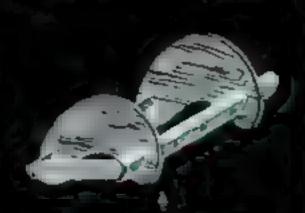
Molding is cut with hackeny. File also may be used. For greatest accuracy in making cuts, a simple miter box to guide saw is desirable.



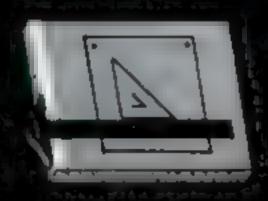




The rack is made by bunding. Stair meeting reversed in a Teleocoping book ands are flat molding and acrewing or shoe rack. Piece of cove see- made with stair noting sliding mailing it to a door. The stair helps support shoes. The in slots in plywood ends.









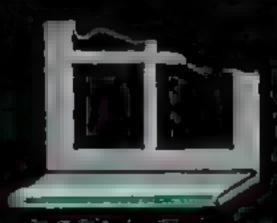
Pep up drinking glasses with Use angle piece as straight. Cheet has drawer slides of two flat strips bolted to ply- edge on a drawing heard, angles while strips of noting wood handles.

Counterink the screwhoods of new new as drawer pulls.





Two lengths of angle, bolted Cove sections zerve as guide Dress up window together and litted in wooden rails for sliding doors of wood ering with knoleum fixtures, make towel rack.



Dress up window sills by covering with knoleum and edging



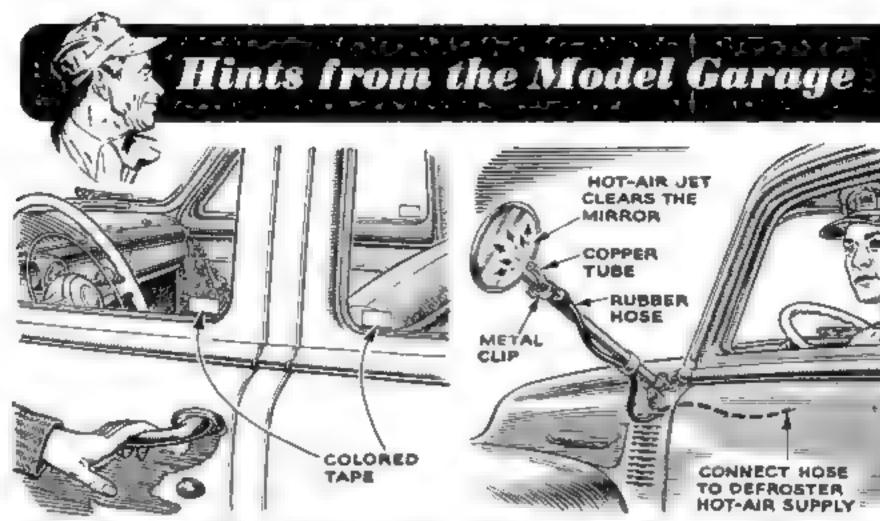
Nost of small tables has angles. Bracket for wall lamp is best for legs. Nail edging around from length of flat molding the tops. - ... ...



and acrewed to wall.



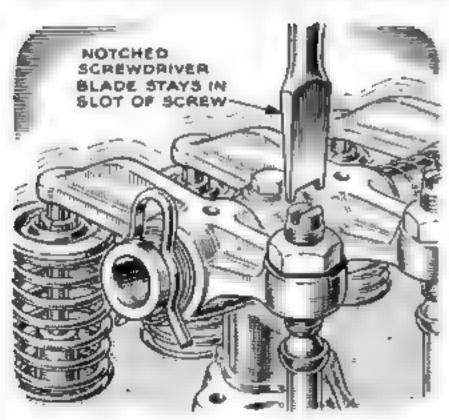
Top and bottom of picture frame is cap molding. Flat strip joins them in back.



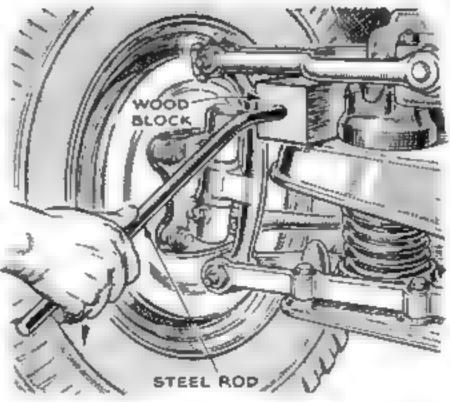
Tape Shows Windows Are Up. If you keep your car windows clean, it may be difficult to tell that they are up when you're locking the ear. Small spots of colored tape applied to the inside near the bottom will show you at a glance.



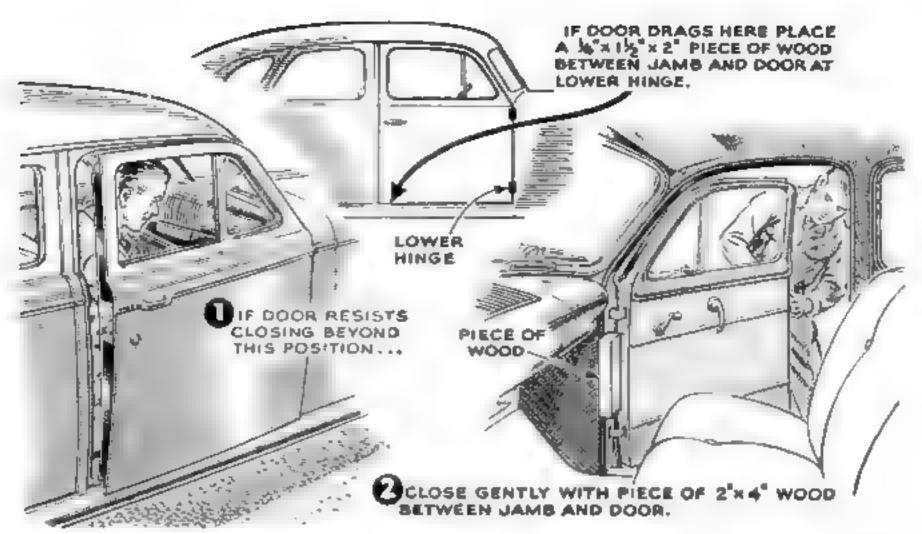
Defroster Clears Mirror. sleety weather, Ronald Weller, of Jerseyville, Ill., found that the rear-view mirror on his truck frequently became coated with ice. To keep the mirror clear, he ran a rubber hose from the defroster out to the mirror.



Tappet Adjustment Is Easier. It is usually recommended that the tappets of an overhead valve engine be adjusted while the engine is warm and idling. However, you've probably found that it's hard to keep the screwdriver in position on the bouncing adjusting screw. To simplify the task, W. M. Dierks, of Chicago, filed a wide notch in a screwdriver blade. This keeps the blade in the slot while adjustments are made.

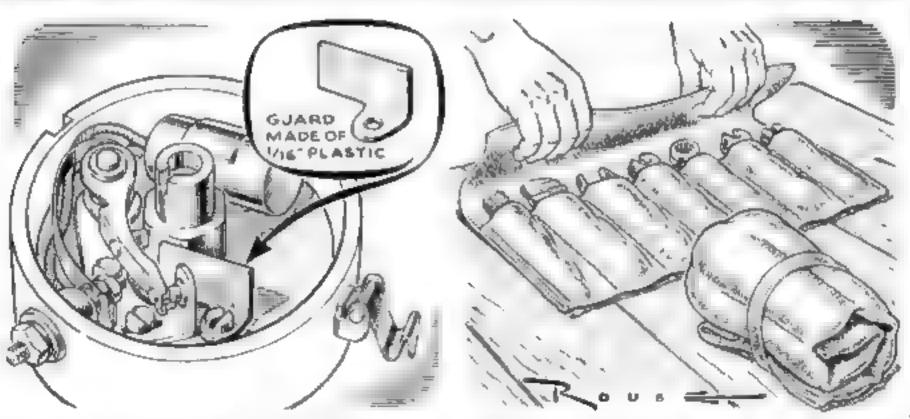


Block Stops Wheel Sag. If you've ever used a humper jack, you've probably noticed that the front of a car must be raised quite high before the tire is free. This is because the suspension arms allow the wheel to sag. You can overcome this by thrusting a block of wood between the frame and upper wishbone. A block cut from 3" by 3" stock will do the job. To position the block, fit a steel-rod handle into it.



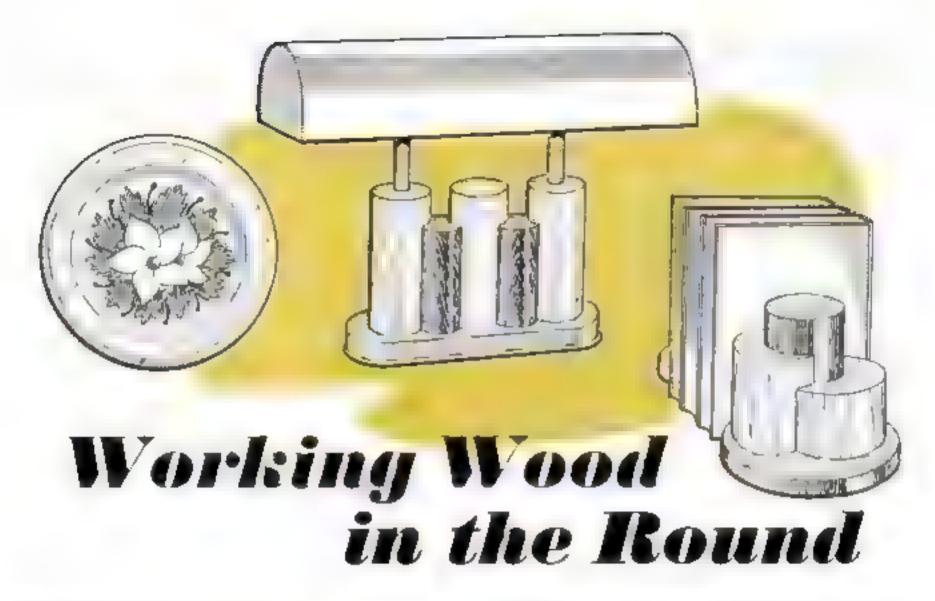
Repairing Sprang Boors. Unless they are too badly damaged, doors with spring hinges can sometimes be put back into working condition by debberately jamming them against a piece of wood. Burk Jaggers, Rushville, Ind., writes that he has

used the method above. In closing the door, always proceed gently and keep testing—or you may have the problem of correcting an overcorrection. Should the door rub at the upper rear corner, place your block of wood between jamb and door at the top hinge.



Gnard Prolongs Point Life, Ira S. Nelson, of Chicago, reports that he has experienced considerable difficulty with burned and pitted breaker points on his '49 Ford V-8 because oil worked up the distributor shaft. As a solution, he installed a small plastic shield between the cam and breaker arm, mounting it with a 6-32 screw as seen above. The shield helps keep oil from being thrown on the points.

Rubber Kit Stops Rattles. This tool kit, made from an old inner tube by Robert R Leist, of New Albany, Ind., keeps small tools from rattling around while carried in the car. Cut a piece from the tube large enough to suit the tools you want to have at hand. Pockets to suit them can be sewn with strong cord. Cut a rubber band from the same tube to put around the kit after it has been rolled up.



#### By Edwin M. Love

ALTHOUGH a lathe ranks as one of the most useful pieces of equipment in any shop, it isn't the only means of shaping wood in the round. You can often fall back on other machines—or even hand tools. Results may not always equal turned work, but nine times out of ten no one will know the difference.

Obviously, you could use a lathe to advantage for projects like those at the top of the page. But they can be completed without turning—a fact that it's well to remember if you have been in the habit of shying away from good craft projects simply because the plans call for a turned member.

And even though you own a lathe, it will pay you to know the alternate procedures. Suppose, for instance, you need a 1%" pole longer than the maximum length your lathe will accept. You can, of course, turn it in sections and join them with dowels and glue. But if you'd rather have the pole in one piece, get a two-by-four and cut it to length, squaring the ends. One edge probably is already square, smooth, and comparatively straight. Using this as a base for gauging, rip a square-sectioned strip that measures slightly more than the desired diameter of the pole.

You can now round the strip either by hand or machine. For hand work you need only a drawknife and a jack plane.

Once the stock has been squared, get out a compass and draw an octagon on one end. See Fig. 1 on page 213. Then gauge chamfers along the edges with a pencil

Holding the work in a vise, pare off the corners with the drawknife—or any other tool that will get the wood down quickly. Finally, plane the new sides straight. For true roundness be sure that all eight sides are equal in width

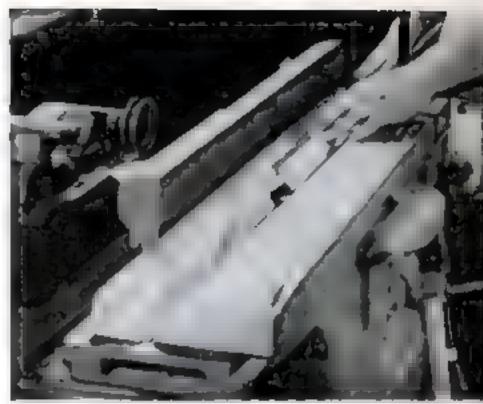
Now grasp the piece with the left hand, butt it against the bench stop, and make three passes on each arms (the sharp corner) with the jack plane, being careful to hold to the same angle for all cuts. Turn the stock end for end to finish the length. If the faces are not equal in width, take off another shaving or two from the narrow ones. Then plane off the new arrises and trim the remaining corners.

Again clamp the pole in a vise. Loop a half sheet of coarse sandpaper around it, grasp the ends with the hands, and pull the paper up and down. Shift position constantly to round the work uniformly. Turn the work and repeat on the other side. This will reduce the comers in a hurry. Finally, sand the piece lengthwise to take off the cross scratches.

Dowels for glue joints are generally purchased ready-made, but if the size wanted is not in stock they can be made in the shop by planing as already described. Or you can save yourself work by driving octagon-



With a plane and a few other hand tools, you can often do jobs that will pass for turned work. Principle here is to cut and plane off successive arrises. Then finally sand smooth.



V jug cuts square stock to octagonal section with one pass of jointer at each corner. The two parts of jug are notched and arch over the jointer head. The jug guides and supports the work

shaped sticks through a hole in a steel plate.

Almost any old iron will do, but the plate will cut better and last longer if made of tool steel. Harden the plate after drilling it by heating to cherry red and plunging in water. Temper by heating until a light brown or straw color shows on a brightened spot, and requench the piece. For small dowels, you can hold the plate in a vise. Heavy driving, however, should be done on the bench top over a bench-pin hole.

#### Shaper and Jointer Round Work

Shop machines that lend themselves well to round work include the jointer and shaper. A jointer rig for reducing a square strip to octagon form is seen in the photo at the top right on this page. It consists of two pieces made by miter-ripping (45°) a two-by-four or two-by-six and notching them to bridge the jointer head

One piece is placed against the fence, the second against the first to form a complete V in which the square stick is supported without rocking. Lower both tables enough to finish a corner in one pass.

Still using the jointer, you can round short, thick work further by pivoting it on nails between two blocks. Fig. 2 on page 213 shows the setup.

Lower the infeed table below the outfeed table equal to the desired depth of cut. Mount the work on the pivots so it is parallel to both tables, although higher above the infeed than the other. This is important. If the axis of the work inclines to one end,



Dowels are shaped in a burry by pounding octagonal-section stock through hole in a steel plate. Sharp edge of the hole acts like a plane, stripping off the wood corners.



A half-round head cutter mounted on the shaper cuts a dowel in two passes—one on one side of the work, one opposite. Align tence set trong use stock as thick as desired character

you'll wind up with a cone-shaped or tapered piece—a good point to remember in case you should ever want to taper a piece in the round. In making the cuts take repeated passes, turning the work a little each time until well rounded. Remove from the jig for hand sanding.

The shaper setup shown in the photo above cuts a dowel in two passes. Mount a half-round bead cutter on the spindle and align the fences. The stock should be just as thick as the diameter of the dowel you want, and the lower edge accurately jointed.

Half the dowel is cut in the first pass. Reverse the piece to put the other face against the fence for the second pass. If the depth of cut has been nicely gauged, the web above and below will be severed and the dowel will fall free with little, if any, offset or ridge appearing. Since all support is lost at the end of the cut, the dowel should be made extra long. Because this setup takes a little time, you'll probably prefer to cut a number of dowels and put them by for future use.

A shaper offers one of the best methods of producing round molded items such as porch-column bases and picture frames. As in all freehand shaping, you need a substantial guide for the depth collar to bear against. In many cases the work itself furnishes the guide. But when the entire edge is to be cut away, make a separate guide and tack it to the work. Fig. 3 on the opposite page illustrates a safe means of shaping the inside of a ring. Scrollsaw the inside only,



Diagonal strokes of cabinet file smooth edge of disk before final sanding. You can do the work faster on a lathe or sander, but filing will serve in tack of such equipment.

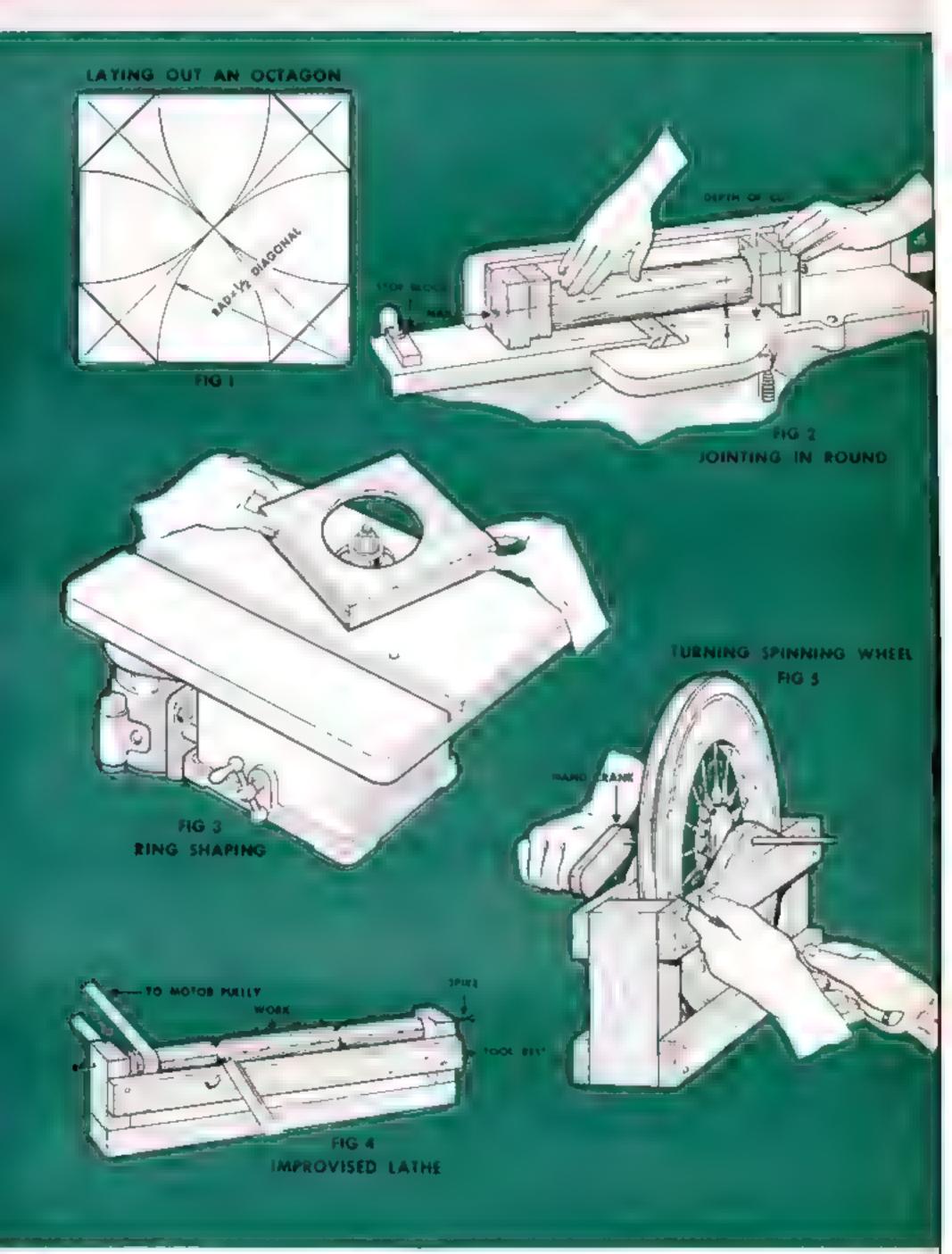
leaving the outer corners for finger holds. When the inside is finished, saw and mold the outside.

By working carefully, you can make perfectly acceptable disks by first cutting them out with a compass or keyhole saw, a coping saw, or a bandsaw. Smoothing by hand can be tedious, but the method shown in the photo above will get it done quickly. To take off the worst roughness, stroke forward and sidewise with a cabinet file. Finish smoothing by rocking a sandpaper block around the circumference. If the block is shaped to fit the curve, so much the better.

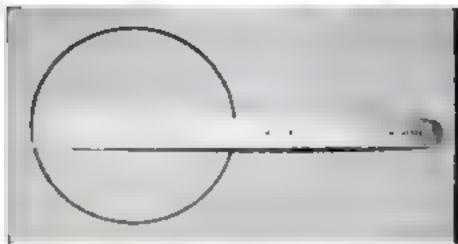
If you'd like to try your hand at actual turning, you can improvise a lathe quite easily, as suggested in Fig. 4 on the facing page. Screw two blocks to a length of two-by-four and pivot the work on nail centers passed through the blocks. Stiffen the assembly with a tool rest nailed or clamped on.

If necessary, you can borrow a motor from your washing machine to drive the assembly. Cut a groove near one end of the work for the belt or whittle down the end and force a pulley over it. The assembly must be spiked or clamped firmly to the bench or other solid support.

Another makeshift assembly (Fig. 5) will enable you to turn a wheel concentric. The illustration shows how you might proceed if you wanted to undertake such a turning project as a spinning wheel. After being cut with a saw, the wheel—and its double belt groove and ornamental side bead—will round to shape if turned by hand.







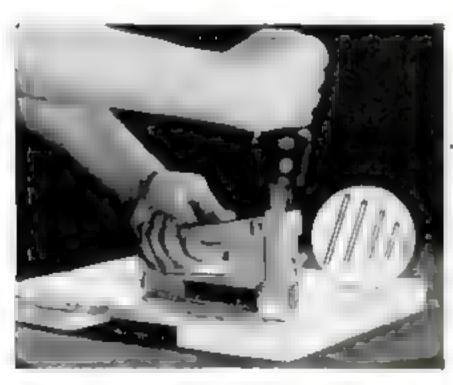


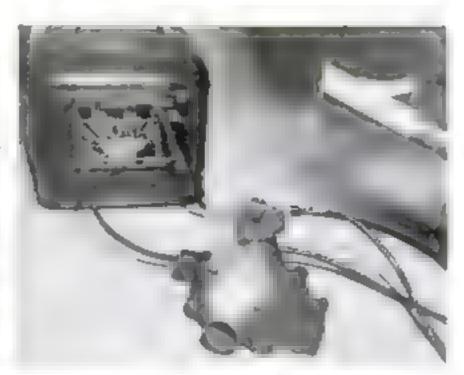
Pocket Rule Does Many Johs. Besides measuring straight lines, this new pocket rule gives direct readings when you need the circumference or area of a circle. For this, it's placed on the diameter of the

circle as pictured at the left above. A sliding clip secures the ruler in your pocket and also serves as a stop when the tool is used as a depth gauge. It's made by Technical Development, Port Washington, N. Y.

Tool Etches Glass. Shaped like a large fountain pen, the Murray Electro-Stylus<sup>®</sup>, at right, can be used to cut stencil designs or carve, engrave, and etch other materials. Electrically operated, it delivers 7,200 cutting strokes a minute. It's made by Murray Industries, Colorado Springs, Colo., and sells for about \$10 with four points. A diamond-tipped point for etching glass is available for an additional \$6.







Hammer with Your Fist. The new hand-operated Heller Nailer® above works hie a paper stapler and is said to enable you to make assemblies four times as fast as with an ordinary hammer and nails. It drives through wood, composition board, and light metal. Heavy-duty staples feed automatically, the device holding 100 or more. Heller Co., Cleveland, makes it.

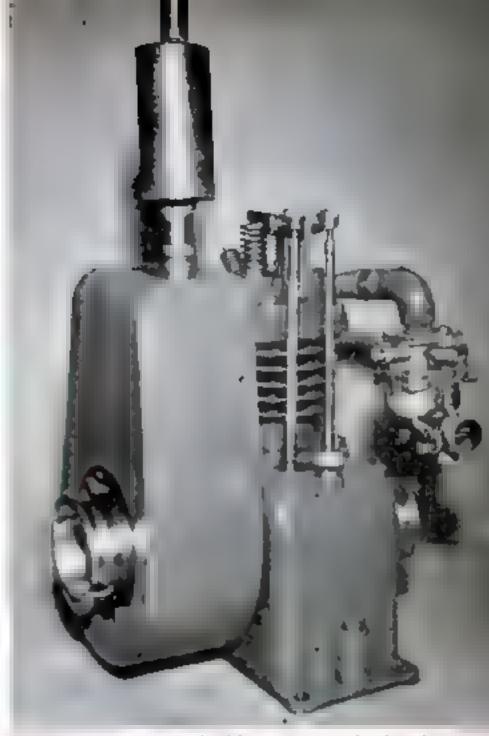
Are Welder for Home Shop. A small transformer-type are welder introduced by Lincoln Electric Co., Cleveland, operates from any 115-volt line fused for 30 amp. It delivers up to 60 amp. and handles 5/64" electrodes. Weighing 50 lb., it can be carried to any spot where you want to weld, solder, or braze. It sells for about \$45 complete with necessary equipment.

# Machining a 2-Hp. Engine From Castings

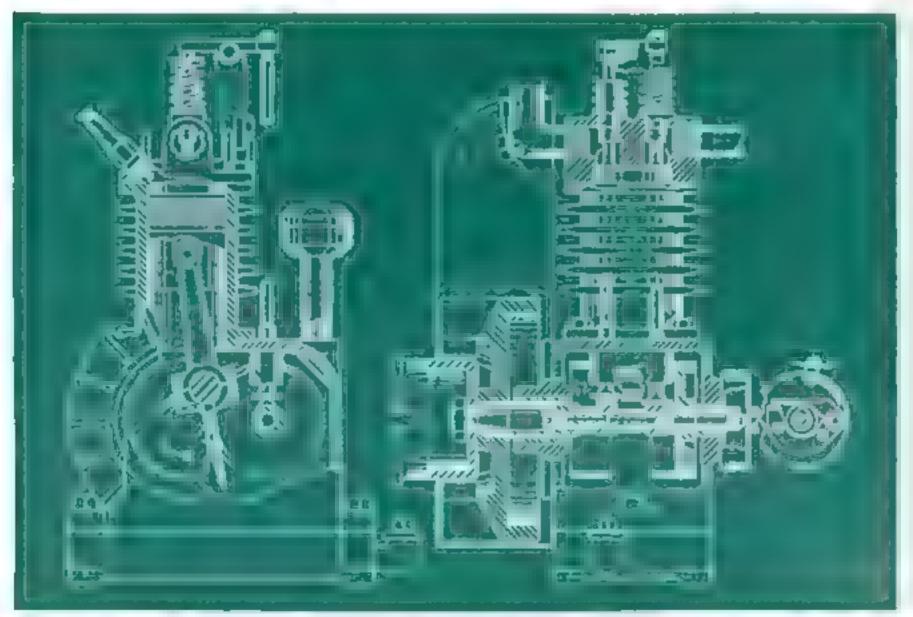
With workshop lathe and drill press, you can transform eight castings into a handy little 1-cycle power plant.

NO TOY, this hasky little giseline crigine is a radical be notified as law imports or prompt A force ongression or prompt A force ongression of prompt A delivers about 2 hp. if 3 500 r.p.m. and can be run r.p. to 5 000 r.p.m. Lie brief periods. If hes a 2" here and 3 a 'stroke and is only 11" high exchaling the nambles.

What's exceptional about it is that you can build it yourself for around \$20 using

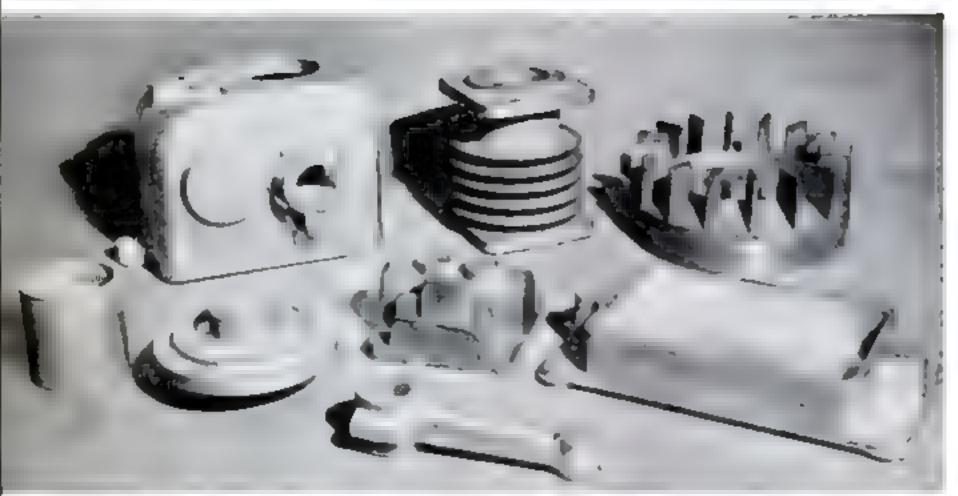


Funshed engine looks like a factory bioli (ib. Not slown are gravity-fred gas tank spark in our free and beyolt ignit it battery.)



Elevation views show clean simplicity of engine. Crankcase lubrication is by splash system.

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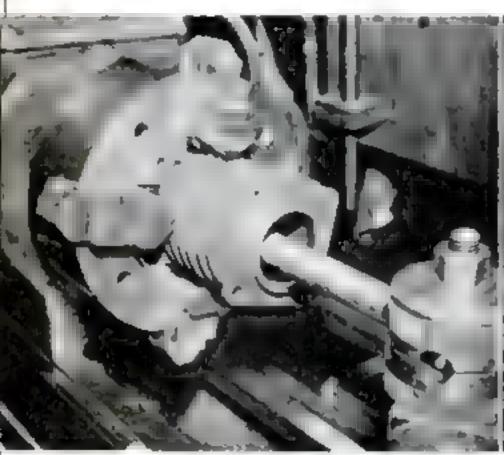
I These are the castings provided. The three darker ones are cust iron; the others are sluminum. In center row, left to right, are the piston, end plate, cylinder head, and oil

pan. In back are the crankcase, cylinder, and flywheel. Con rod is in front First cuts on the iron castings should be fairly heavy to get under the foundry scale as fast as possible.

only a 9" lathe and drill press. The engine was originally designed as a class project by W. L. Nasht, instructor at the Glendale High School, Glendale, Calif. For \$15.50 f.o.b. Glendale, he'll ship anyone all required eastings, plus piston rings and jobsheet prints. Bar stock and blanks for shafts and gears cost an additional \$3. Prospective

builders will have to provide themselves with a carburetor (a secondhand motor-scooter one will do), distributor points and coil, and miscellaneous stock and fittings.

Building the engine isn't hard, although a beginner at the lathe shouldn't try it. A milling attachment is desirable but not indispensable so long as you have an "arm-strong



4 Cylinder is faced and bored with care. Resharpen boring bit and use a light cut and slow feed as diameter approaches 2 000". Watch out for "bell mouth" or taper in bore.



5 Bottom of head is faced and combustion chamber turned out with casting gripped in the 4-jaw chuck. Then head is reversed, faced, and valve holes accurately located and drilled.

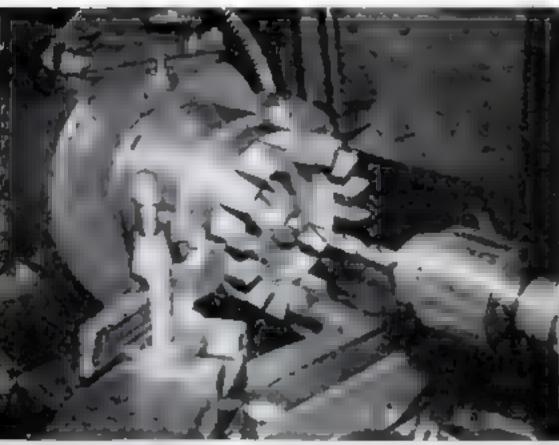


2 After bottom of the crankcase has been faced flat and smooth (surface must later seal in oil), casting is clamped to faceplate as above, and bored and faced for the cylinder.



3 Given a quarter turn and chucked by bearing boss, the crankcase side is faced A 1" drill is also run through the boss, which is later opened out to 1 3/16" for crankshaft bearing.

shaper"—that is, some files. Nasht's job sheets, planned with his students in mind, call for cutting the gear from blanks; most builders will prefer to fit ready-cut gears. Accurate machining is important, especially on the piston and cylinder, and construction shouldn't be done in a hurried or skapdash way if you expect best results.



6 The flywheel is a simple turning and drilling jeb. Here it's held by taiside clucking on back. Next it is reversed chileked on the tried boss, and bored out to Final diameter.



7 Con rod is finish-machined only after the big end has been drilled for esp screws out apart tupped and reassembled. The wrist pin hole made on drill press is remined to \*".



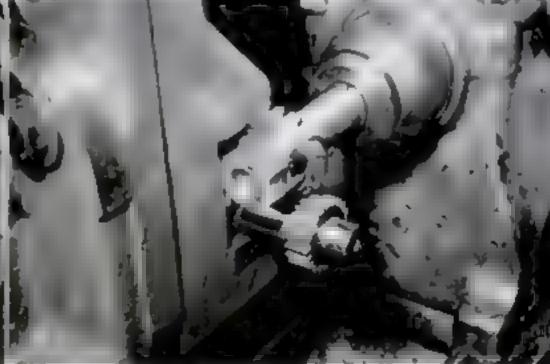
8 Piston can be chucked directly a shown but it is better to sent it or a stub areas word gives in his tool of area in dissers like a good of skirt instorted from the same.



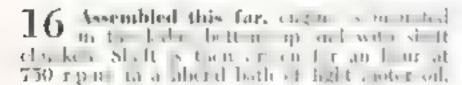
9 Crankease end plate, here being feed and it had by W. L. Neste is a sucparsetup Or here, through the service external mental state drill then bere into



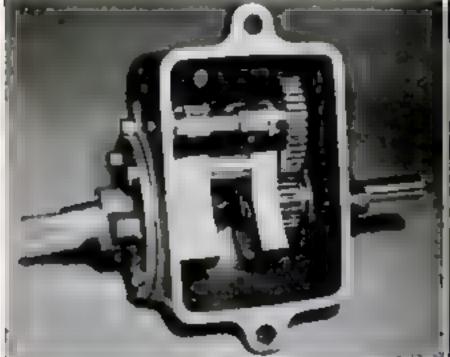
12 Comshaft is reaghtermed, can I best and and make I best to a sheet with a He and can't be and can't be a sheet with a He and can't be a sheet with a heart of the sheet with a heart of the sheet with a sheet wit



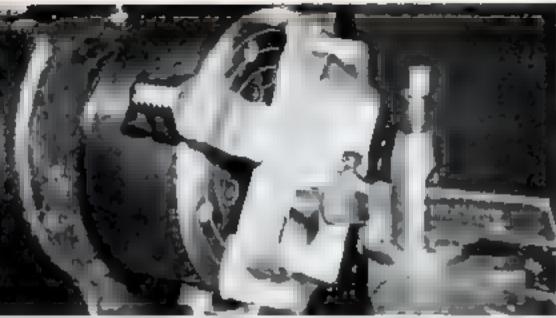
13 Crankshaft gear, which has 22 teeth on he at a malling the bond had a head or prochamate the ign piper, attermised to teeth has a general new one according



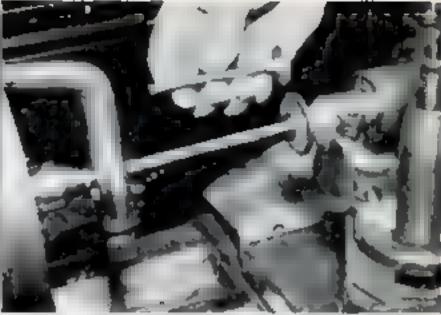
17 Check dimensions carefully believed in the form of with two pictures and mass I have out spark all g to provent compression witch for reagleness, building, or overcoding



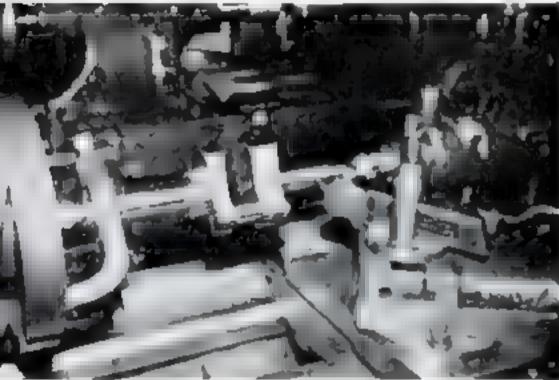
218 POPULAR SCIENCE



10 Oil pan is faced absolutely flat to make tight point with crankcase. To lipost and g by must be palled up tight to prove tripples on or go. Six ledes are then dride ton the pan-



11 Old valves from a Ford or Clavrel tore tunned down inter-circled center rilling Use a circled bit if available the stock is tough Later stem is crosser less for a returning part



1.4 Crankshaft is assembled from five pieces and gent using crive bits and pins. Spicer is ten, really placed between each terw shis. Here a cranks saft journal is east some



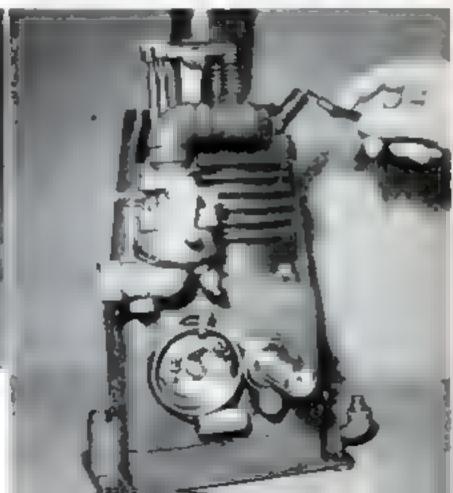
15 Four holes in the top of the cylinder are located with the land in place helps in the bottom of the cylinder have it indy been drilled for the bottom of the cylinder sensitives.

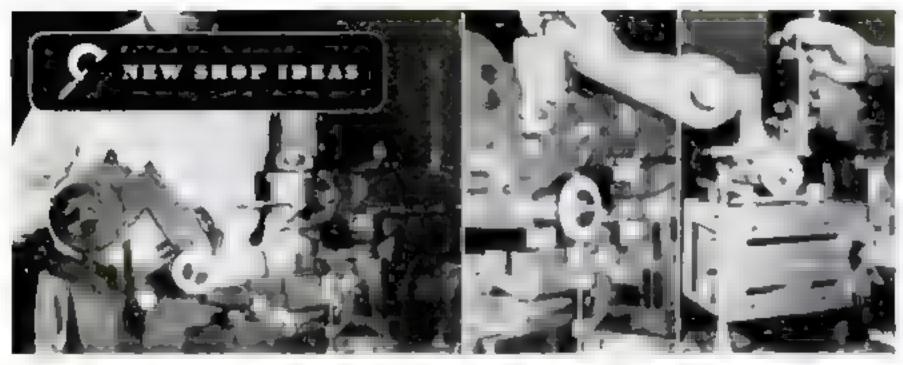
18 Pushrods, guides, and rockers in the struction water in claiming jets, stratus, from bar or flat cell-rolled stock Springs are wound from .062" and .080" masic with

19 This completed engine his a litter spark plug a several and fing six Strit his carbureter and acits distribute points cooling shroud and mailly are sheet need



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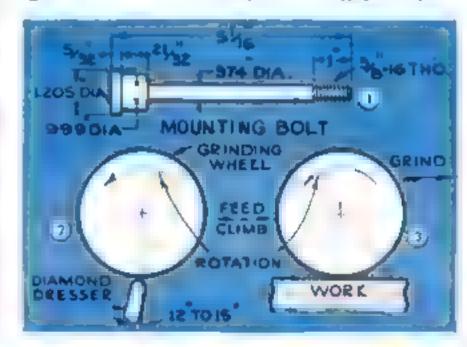
Shaper Is Surface Grinder. An ordinary shaper and a lathe tool-post grinder can be combined for precision surface grinding. Mount the grinder on the shaper as above with a special bolt (Fig. 1). Work can be secured to the knee, clamped in the vise, or held with a magnetic chuck.

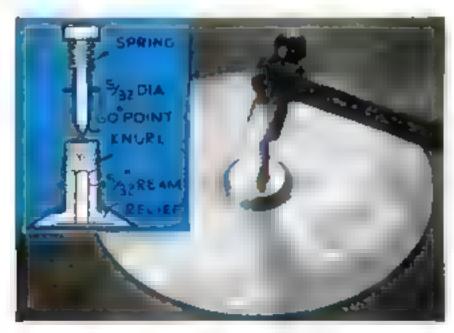
Dress the grinding wheel by clamping the dresser in the vise as in the center photo. Feed the rotating wheel into the diamond with the clapper feed and across the diamond with the knee feed. Set the diamond on the wheel centerline (Fig. 2).

On work, set the shaper to feed as in Fig. 3. Take light cuts of .0005" to .001" and make the last one without an advance. Tie down the clapper to prevent skipping. Fol-

low the manufacturer's recommendations as to the type of granding wheel.

Be sure to wear goggles and use a wheel guard.-L. W. Bonnell, San Diego, Calif.





Punch Hits Exact Center. After you have laid out two right-angle center-lines to locate a hole, this punch enables you to start the hole precisely where the lines cross. Around its rim are four notches 90° apart. When these are lined up visually on the four lines, the punch is automatically centered. Turn the base from brass and ream it so the punch will be an easy sliding fit.—Joseph Tracy, Manhattan, N. Y.

Auger Bit Used in Drill Press.
A split bushing made by drilling a short length of %" drill rod lengthwise and cutting it in half with a backsaw will enable you to mount a standard wood auger bit in a drill-press collet chuck. The rod should of course be drilled the same diameter as the shank of the bit. If the drill shank is not quite round where it merges into the square taper, dress it slightly with a file so it will seat firmly in the split bush-

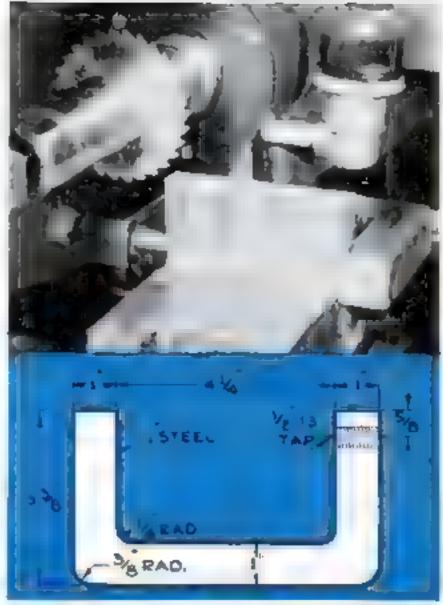




Shield Magnifies Work. An inexpensive magnifying glass mounted on a lathe as above will serve two purposes—give you better vision while doing close work and protect you from flying chips.

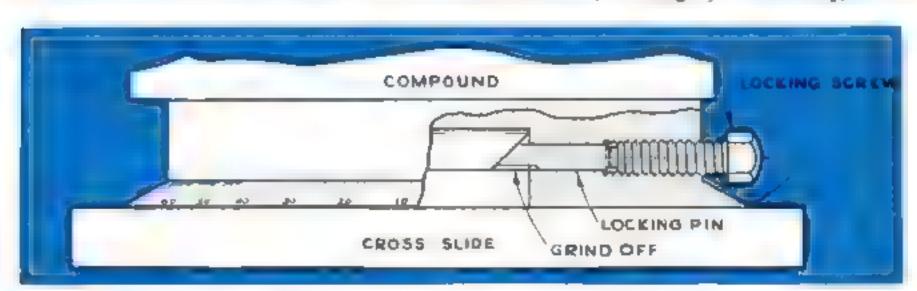
It's best to use a wire clip to hold the glass. Frequent cleaning is necessary and a rim would make this more difficult. An L-shaped bracket clamped under the toolpost screw supports the assembly. A pivoted extension on top permits adjustment.

Roll Your Own Teo. Cigarette papers are often useful around the shop. To pick up a cut with a milling cutter or tool bit, hold a paper between cutter and work You'll feel the cutter just as it contacts the work. Use as shims to true up work in a slightly eccentric three-jaw chuck, and in vise jaws to prevent marring. Once you have the habit you'll find many other uses.



Work Ganged for Milling, it's often advantageous to stack work parallel to the milling cutter and do the job with one pass. For this, the vise usually is not satisfactory, since stock variations and uneven clamping may leave some pieces loose.

The husky clamp illustrated above overcomes this difficulty. The dimensions suit it to a 3h" milling vise. It's used as shown in the photo. While the vise jaws exert pressure in one direction, the clamp works in another. This two-way clamping prevents movement.—J. C. Magee, Schenectady, N. Y.



Stopping Lathe Chatter. In small lathes, the pins that lock the compound rest on the cross slide may cause chatter if they ride on the collar below the inverted cone. To check for this, take off the compound, clean carefully, coat with a film of oil, re-

store it, and draw up the locking screws. If the oil is drawn in instead of being pushed out, it's a sure sign the pins are riding. The remedy is simple: grind .010" to .015" from the lower edge of each of the pins.—L. L. Seveheck, Westfield, N. J.



Acetic acid shortstop helps prevent developer stain and doubles life of fixing bath, Prints

can be left temporarily in shortstop and then be transferred in batches to the fixing bath,

# Print Your Pictures for a Lifetime

They'll last practically forever if you fix, wash, and mount them carefully. Here's how to do it.

By Kenneth M. Swezey

SOME rainy day half a century from now, your grandchildren may start rooting around in the attic. Chances are, they'll dig out an old album or dusty box of photos, among them several you proudly pulled from the developer away back in 1949.

The youngsters will grin, perhaps laugh aloud, at the strange costumes. But what about the photos? Will they be stained and faded—like those you've probably seen in your own grandpop's attic? Or will they still be bright and erisp?

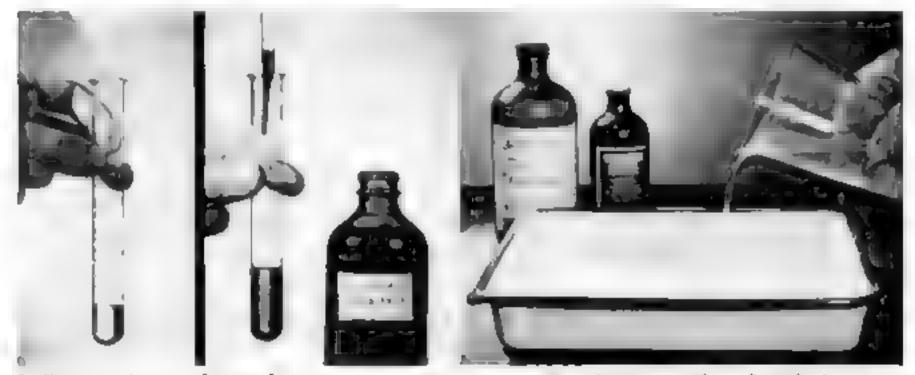
It depends on you. With care, you can make prints that will last as long as the paper on which they're printed. But you must pay exacting attention to the drab jobs of fixing, washing, and mounting.

When you watch a print in the fixing bath, nothing seems to happen. But don't let that fool you. The hypo must dissolve all undeveloped silver salts, or they'll eventually cause overall darkening of the print. In turn, thorough washing is required to carry away the hypo. If any remains, sulphur in it will react with the silver image, producing yellowing and fading.



Rock the fixing tray frequently and manipulate prints occasionally with tongs. Make sure the solution reaches the surface of each print.

Washing carries away hypo and soluble silver compounds from paper. The circulating system must keep fresh water in contact with prints.



lodine-starch test detects hypo remaining on prints. Drip water from print into tube, add solution. If it loses blue color, hypo remains.

Ammonia solution, used as described in text, removes last trace of hypo. This will help you keep valued prints bright indefinitely.

If agitated constantly, a single print should fix in about a minute in fresh hypo. But under ordinary conditions, it's best to leave prints in the fixer about ten minutes.

Unfortunately, there's no easy test to tell when hypo has reached the end of its useful life. The best you can do is remember that the conservative life of typical acid hardening solutions, such as Kodak F-1 and Ansco 201, has been determined by experiment. Under normal conditions, a gallon should fix about 60 eight-by-tens (or their equivalent) that have been rinsed in plain water, or 120 such prints if acid shortstop is used. Make this shortstop by adding 1% oz. 28-percent acetic acid to 32 oz. water. Swish prints in it for at least five seconds.

A rapid flow of water doesn't greatly speed up the washing time of prints. But be sure a supply of fresh water constantly

circulates around the prints. Wash singleweight prints at least 30 minutes, doubleweight at least an hour.

One of several chemical tests will tell you when a print has been safely washed. The iodine-starch test, for instance, detects I part hypo in 2,500 parts of water. A formula recommended by Defender consists of three solutions that are mixed just before using. The separate solutions will keep indefinitely in well-stoppered bottles. An amber bottle preserves the mixture briefly

Make solution A by dissolving % oz. potassium iodide and 50 grains iodine crystals in % oz. water; add water to make 4 oz. Make solution. B by dissolving 10 grains soluble starch in 4 oz. water; heat to boiling and cool. Solution C consists of % oz. concentrated hydrochloric acid diluted with 3% oz. water. To make the test solution,

add 18 drops of solution A and an equal amount of solution C to % oz. of solution B; add water to make 4 oz.

Use by letting water drip from a print into a tube and adding an equal amount of test solution. If the blue test solution loses its color, hypo remains in the print.

Even with prolonged washing, a minute amount of hypo inevitably clings to a print. Ordinarily, you needn't worry about this. For valued prints, you can remove this last trace with a solution that changes the hypo to a compound that washes out more readily.

Make this by mixing 4 fl. oz. hydrogen peroxide and 3¼ fl. oz. of 3-percent ammonium hydroxide (ammonia water) with 25 oz. water. After washing the prints for the usual time, immerse, for six minutes in this solution. Wash ten minutes longer.

To make a very delicate check on the existence of traces of hypo in your prints, process a blank piece of photographic paper along with the prints. After washing has been completed, cut a strip from this paper and immerse it in a 1-percent solution of silver nitrate. (Be careful: this is corrosive and poisonous.) After immersion of the strip for several minutes, compare with the wet paper from which it was cut. A yellow-brown tint indicates the presence of hypo.

Even when prints are well fixed and washed, hydrogen sulphide in the air may cause them to yellow and fade. This can largely be prevented by treating the print in a solution that coats the silver with gold.

Make the solution by adding 25 fl. drams



Dry mounting tissue is safest way of mounting prints. Most pastes contain a certain amount of sulphur. This will cause prints to fade

about X fl. oz.) of 1-percent gold chloride stock solution (made by dissolving contents of 15-grain tube in 3% oz. water) to 24 oz. water. Dissolve 145 grains of either sodium or potassium thiocyanate in 4 oz. water. Add slowly to the first solution while staring rapidly.

Immerse the washed print in this solution for ten minutes at 68° F., or until a faint change in image tone (toward blinsh-black) takes place. Wash ten minutes.

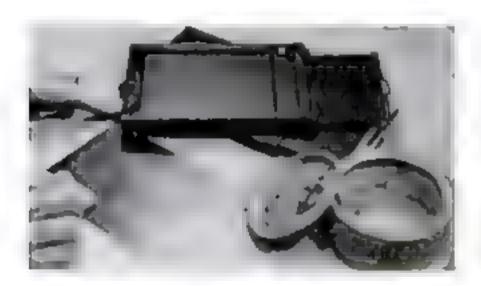
Silver nitrate solution gives a very delicate check on hypo in prints. Immerse a piece cut from blank photo paper processed and washed along with prints, If the immersed strip shows a yellow-brown tint, as indicated below, the prints all should be given further washing.



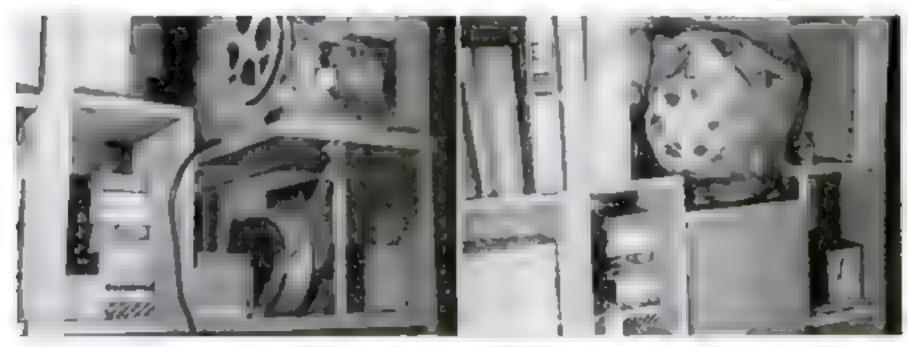


Gives Choice of Neg Size. An adapter kit offered by Eastman enables the owner of a Kodak Tourist<sup>®</sup> camera to take pictures in four negative sizes—8, 12, or 16 on 620 film, or 8 on 828 black and white or Kodachrome<sup>®</sup>. For the latter, the kit includes spool adapters as well as a mask. A special back meters the film for the different neg sizes, and view-finder masks cut down the image as necessary.

Movie "Box Camera." The new 8-mm. Cine-Kodak Reliant Camera® was especially designed to be as easy to use as a box camera. There are no sprockets to worry about while loading the roll film, and a prefocused 13-mm. f/2.7 Kodak Cine Ektanon® lens requires no adjustment for subject distance. Taking speeds are adjustable from 16 to 48 frames per second, and the finder indicates parallax correction.

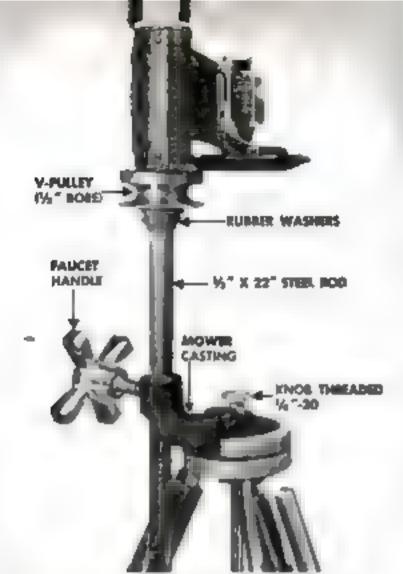


Keep Dust Out of Holders. Do your negatives look as if they have measles? If so, dust in the film holders may be the cause. To avoid this, dust the holders occasionally with a cloth or a soft-bristled brush, making sure you get dust out of the thin metal film guides. At the same time, wax the dark slide and wood portions of the holder. Wax helps keep the slide free of dust—C. W. Hamilton, Seattle, Wash.



Projector Fits into Bookease. In most bookeases, the shelves are too closely spaced to allow room for a movie projector. However, you can cut out a section of one shelf and lower it as at right above.

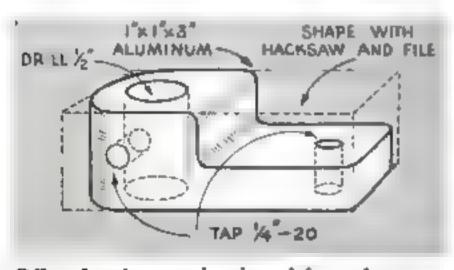
A hinged door under the shelf swings up and is held by a spring-lock bracket to provide a platform for the projector in use. Reels and other items are stored behind the door.—Donald B. Terrana, Brooklyn, N. Y.



Pulley serves as platform for camera or conventional pan-tilt head. Put the pulley on the end of the rod and secure it with setserew.



Turn ¼"-20 screw into hole drilled and tapped in end of rod, letting it project ¾". Rubber washers cushion head if it fulls accidentally,



Offset bracket can be shaped from aluminum or other metal if mower casting isn't available. Faucet handle locks rod in desired position.

# Elevating Head Improves Tripod

ORDINARILY you turn to a camera store for photo accessories. But this elevating tripod head is different. Its parts all came from a hardware store.

A search of your home and shop may turn up most of them—or at least satisfactory substitutes. Besides the items shown at the left, you need only a couple of %"-20 machine screws. Cut the heads off these. One goes in a hole drilled and tapped in the end of the elevator rod, and the other in the faucet handle. Setscrews secure the one in the faucet handle.

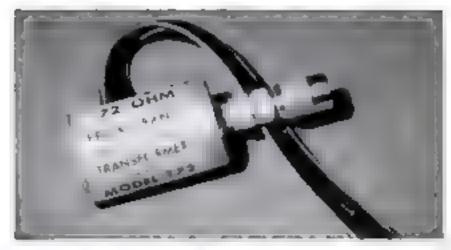
A disearded lawn mower is the source of the casting that offsets the elevator rod. It originally held one end of the roller. Drill and tap the sidewall of the large hole for the machine screw that you've fitted into the faucet handle.

If you wish, you can place a pulley and tripod screw at both ends of the elevating rod as shown below. This allows a wide range of camera positions up and down. On occasions, the elevator is handy as a light stand.—John P. Arnold, Doylestown, Pa.

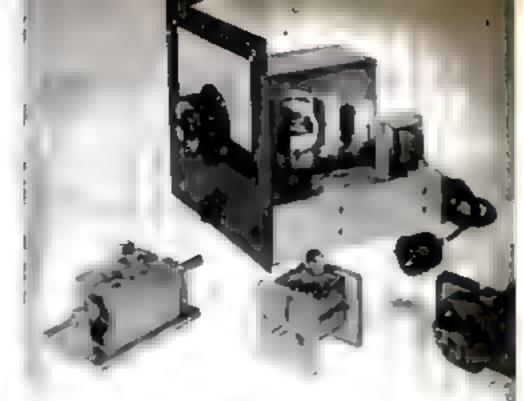


Off-the-floor shots are taken with ease, Just drop the elevating rod and fit a pan-tilt head to a similar mounting on the bottom end.

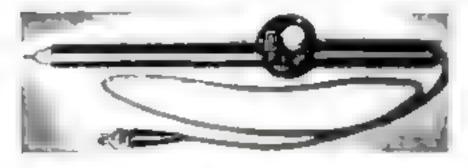




Transformer Matches Lead-In. A small transformer made by Workshop Associates, Newton Highlands, Mass., feeds from 72 ohms at one side to 300 ohms at the other. With it TV set owners can match coaxial cable to 300-ohm input terminals. It also can be used in reverse to match 300-ohm twin-lead to a 72-ohm input. Mismatching between antenna and receiver often accounts for weak signals or interference.



Converter Receives UHF. Television sets need not be made obsolete when new ultra-high frequency channels are opened for video broadcasting. A converter developed by Stanford Research Institute steps down transmissions in the 475 to 890-mc, spectrum to the lower frequencies that present-day sets can receive. The converter is connected between the antenna and the antenna-input terminals of the receiver.



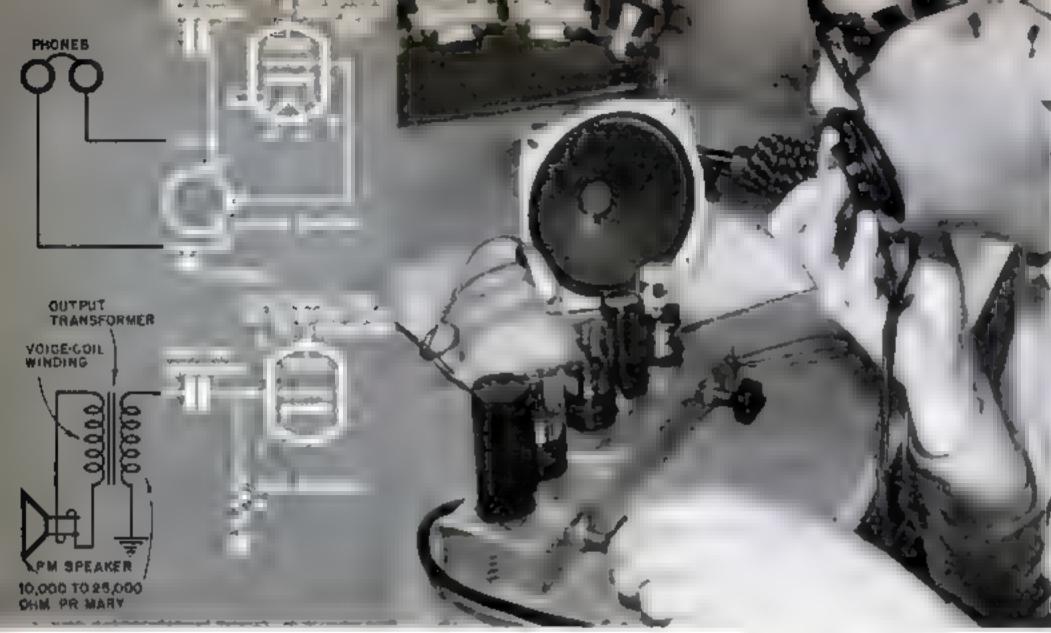
Splicer Joins Recording Tape. Editing of magnetically recorded tapes may be made easier through the use of the splicer shown below. It cuts and rejoins tape ends by means of a plastic weld without adding to the thickness of the tape. Prestoseal Manufacturing Corp., Long Island City, N. Y., makes the unit to sell at \$65.

Neon Lamp Thecks 30 KV. An inexpensive voltage checker using a neon lamp instead of a meter has now been adapted for high-voltage applications by Industrial Devices, Inc., Edgewater, N. J. It will read up to 30,000 volts.

Earset Eliminates Headband. No band or strap is needed to keep the new Telex Earset<sup>®</sup> in place. A plastic frame slips onto either ear to hold the earpiece in position. The single-cord connection also allows the user greater freedom of movement, Telex Inc., Minneapolis, manufactures the device. The 5' cord is removable.







1, Headphones or even a loudspeaker will often replace a crystal microphone. Drawings at

the left show connection to common radio circuits. Above, phone is used to test amplifier.

# Radio Parts from Your Scrap Box

Though most components are designed for particular jobs, you can make many of them double up in a pinch.

# By Frank Tobin

IF YOU'RE a typical radio experimenter, you know what it means to be stuck for a vital part when the stores are closed. Since many amateurs do their work nights and holidays, it happens to a lot of people. Next time you run into that situation, take a look in your spare-parts box. You may not see what you're looking for, but perhaps you'll find at least a temporary substitute for the part you need.

The first rule for making spare parts work for you is to keep them in good order. Separate components by type and value, and never, never toss in a defective part without marking it. If you know a condenser is shorted or open, throw it away. A transformer with one winding open is worth saving, however, if you tape on a note that tells what's wrong with it.

With a fair selection of resistors you should never be too badly stuck for a particular value. Connect smaller ones in series to add up to the total you want, or in parallel to get a lower value. The same is true of condensers, but in reverse.

Headphones and loudspeakers are usually thought of as reproducers but they will also operate as microphones in a pinch. A single phone will give fair volume with two stages of amplification, as in an AC-DC receiver; both phones will do even better. For such use, connect it as shown in the upper sketch. In some cases it may be necessary to make the connection at terminal C of the volume control instead of terminal A. If the amplifier has a microphone-input jack, you'll use that, of course. As you can see in the diagram, no special coupling is needed; the condenser and volume control are already in the set.

To use a permanent-magnet speaker as a microphone you need a transformer to match the voice-coil impedance to that of the amplifier grid. The best bet is to use a regular intercom transformer which has a secondary winding in the neighborhood of 70,000 ohms. Lacking this, try an ordinary output transformer, selecting the highest primary impedance available. Wire them as shown in the lower sketch of Fig. 1; black lines represent the parts added to those already in the set.

The humble wafer socket has the makings of a test-point adapter (Fig. 2). The wafer socket must be of the same base type as the tube to be checked. Invert the socket, push in the tube, and plug both tube and test socket into the socket on the chassis. It may be necessary to clip the prong sleeves on the wafer socket to allow the tube pins to extend through. Bend back the soldering lugs.

You may find yourself short of test prods at a bad time. That's nothing to worry about if you have two mechanical pencils around the shop. These pencils make good substitutes for prods (Fig. 3). They should have plastic barrels, or you may find yourself holding a piece of high voltage. Make sure that a good contact exists between the metal ferrule on top of the pencil and the metal tip. Wedge the wire from the meter under the eraser cap or solder it on.

### Coil Forms from Spools

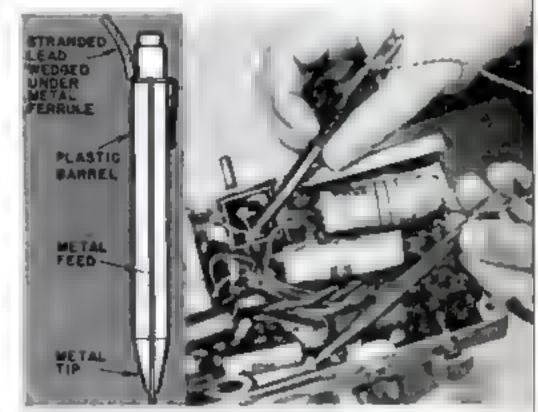
An ordinary wooden pencil, by the way, will make a fine core for a high-frequency choke. Such chokes are widely used in FM and TV receivers and in other high-frequency equipment. Leave the graphite in the pencil; it takes the place of a powdered metal core. Saw off a 1" piece and wind the coil around it.

Other substitute coil forms can be salvaged from flashlight batteries or a sewing box (Fig. 4). In the former case, slip the cardboard sleeve off the cell; in the latter, use a wooden spool from which the thread has been removed. Finished coils will stay neat longer if they are coated with liquid coil dope.

Have you ever thought of employing a power transformer as an output transformer? Even a defective unit can be used at times. In Fig. 5 a fairly common transformer type is shown in this unconventional application. Using half the high-voltage winding between the plate and B plus, and em-



2 Test-point adapter, easily made from wafer to be sucket allows you to check voltages at the tube instead of turning chassis over



3 Need a pair of test prode? Try using mechanical pencils. Be sure they have plastic barrels, for the metal parts may be "hot



4. Coil forms can be improvised from many common objects. Windings must, of course, be figured in relation to diameter of the form.





5. A power transformer can be used in place of an output transformer. It's an expensive sub-

stitute, but it will work nicely until you get a chance to put in the correct replacement unit.

ploying the 5-volt rectifier winding for the voice coil gave a surprisingly good match between a 35L6 power tube and the speaker. For other tubes and speakers you can try a number of other combinations. The 6.3-volt secondary, for example may be used in place of the 5-volt one. Also try the entire high-voltage side, or half the 6.3-volt winding.

A push-pull audio transformer can be made from two angle-tube transformers if they're wired in series as shown in Fig. 6. First try connecting one grid and one ground lead together at the center tap. This may not be the best arrangement, however, so experiment with others.

By juggling the filament windings on an old power transformer made for 5-volt and 2.5-volt tubes, you can obtain 6.25 volts. This means you can use the transformer in a circuit employing modern 6.3-volt tubes. Note, however, that you no longer have a 5-volt tap for the rectifier, so you'll have to use a 6X5 or similar 6.3-volt rectifier, heating all tubes off one winding.

### Subs for Filter Chokes

It often happens that a serviceman or experimenter is stuck for a filter choke. It may occur when you replace a field-coil speaker with a permanent magnet one, for the field coil frequently doubles up as a choke. In a pinch you'll find a filament transformer is a pretty good substitute. Lacking a filament transformer, try using the primary winding of an output transformer in place of the missing choke. Both applications are pictured in Fig. 8.

Figure 9 illustrates another possible transformer dodge. The photo shows a universal output transformer being used to feed

6.3-volt tube heaters. This won't work in all cases, but by trying the various taps on both primary and secondary you may be able to find a combination that steps down 115 volts to a value very close to 6.3. Test the voltage on an AC meter before risking the tubes. The transformer should be rated at 8 to 10 watts or higher; smaller ones will overheat. The voice-coil winding goes to the tube filaments while the primary is connected to the 115-volt line.

### Selector Switches

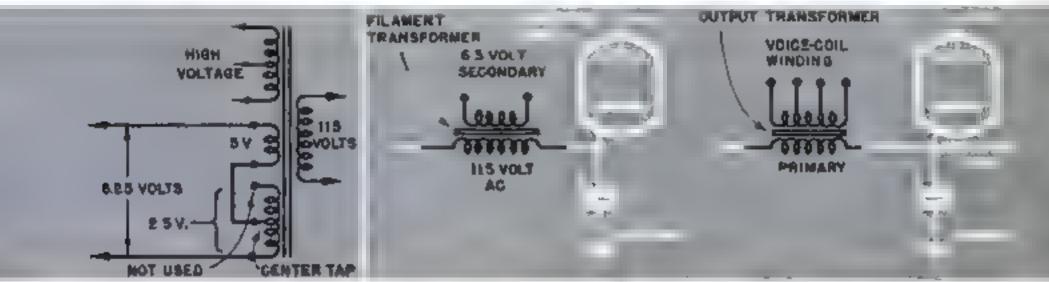
If it's a low-voltage switch you want, you don't have to hunt very far. A few nickelplated wood or machine screws will do the job nicely, as pictured in Fig. 10. The setup shown is a test circuit in which a universal output transformer is used to feed a number of different speakers. Instead of soklering and unsoldering a number of connections to find the best match, make a selector switch by driving the required number of screws into a scrap of wood. Place them in an arc arrangement so that the moving arm—which can be a flat brass or plated bracket about 1%" long-will make contact with each screw head. A small wooden knob can be attached at the end opposite the pivot screw.

Parts substitution of the kind described above may not save you much money, but it will save a lot of time and energy. Obviously it doesn't make sense to buy a 83 power transformer in order to replace a filament transformer that costs half as much. But if you happen to have the more expensive unit gathering dust, you won't lose anything by putting it to work. If this makes it possible to finish the building or repair job you're doing, it will often put you ahead of the game.



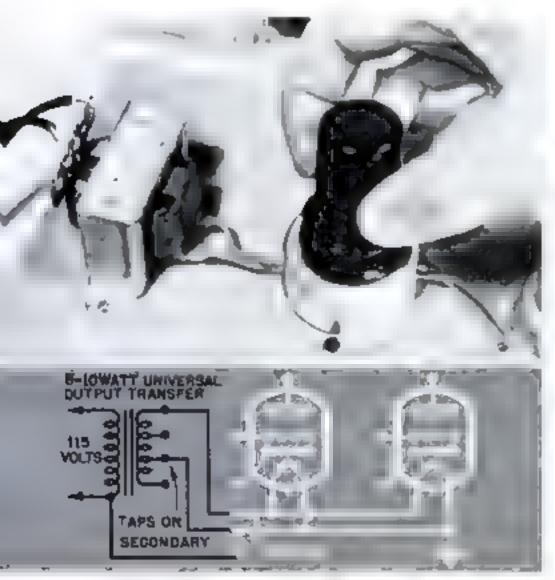
6. Two single-tube is ho transformers in do a next removement by a passional transformer.

Depen wights transformer make riell d of connection may vary try-different co-dimations.

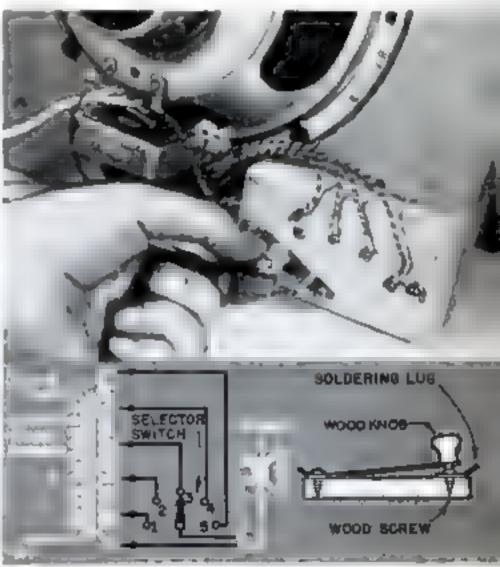


7. Old transformers for 2.5 and 5-volt tubes can be used in modern currents with 6.3-volt beaters. This arrangement gives 6.25 volts.

8. Filter chokes now be approved from offer filament or output transformers. One was long isn't used; it can even be open or shorted

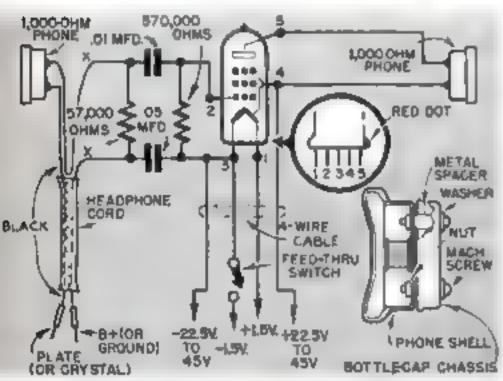


9. Heater voltage can be furnessed in many ways one of the mone an issued in a set trace as output transformer. Lest tap to a beneficial.



10. Selector switches are a cincle to make A couple of serious and a flat metal arm do the trick Use seldering lags for the contacts

Get more stations at better volume on your crystal and one-tube receivers by using amplifying phones. They'll work with any set



Tube connections are soldered directly to the pins. Use a small iron and try to solder each joint quickly; too much heat may cause damage

All parts, including tube, are mounted inside the bottle cap, Battery and phone wires are taped together to keep them from snarling.

# Amplifier Fits On Headphone

You'll listen more comfortably to your crystal and one-tube receivers with a pair of amplifying headphones. And you'll also find them helpful for signal tracing, checking phono cartridges, and the like

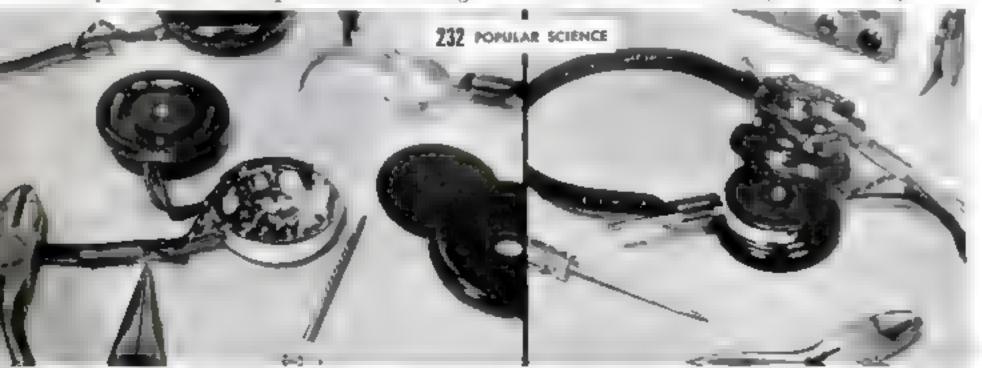
This amplifier, built on an ordinary pair of 2,000-ohm phones (each phone is 1,000 ohms) will work with any type of set. The whole amplifier, less batteries, fits into a metal bottle cap measuring 1%" across by only %" deep. This bottle-cap chassis is bolted to the back of one phone. Since the cap is in effect grounded, you'll lessen the chance of shorts if you line it with cellulose tape. Also tape the bolts and spacers.

Initially the two sides of a pair of headphones are wired in series, with the common wire running down to the yoke and back up the other side. To connect the amphilier, remove the leads from the phone carrying the bottle cap and connect them to the points marked X in the diagram. The two phone terminals are then wired to pins 4 and 5 of the tube.—Albert Rowley, Manhattan, N. Y.



Insulate the bottle-cap chases with tape. The holes in back are for mounting; drill two more in the rim to clear battery and phone cables

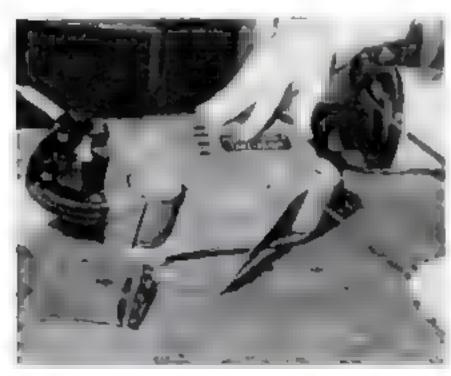
Amplifying headphones complete except for the batteries. Use a 1.5-volt flashlight cell and a 22%- or 45-volt hearing-aid B battery.





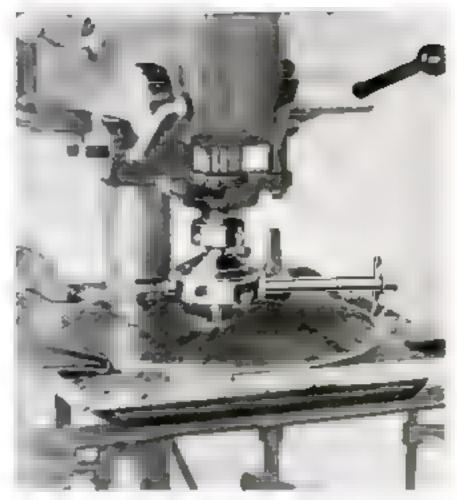
# New Knives from Old Blades

For collet-type knives, such as the one pictured above, you can make yourself a supply of new cutters by breaking old razor blades. Hold the blade with phers and snap off pieces with needle-nosed pliers. By careful breaking, you can get a variety of shapes. —G. E. Harrington, Manhattan, N. Y.



# Soft Shoe for Final Sanding

On Final sanding jobs, portable belt sanders tend to leave fine dents in the surface unless the metal shoe is replaced by a woven asbestos shoe. The extra thickness of the belt at the lap causes the dents. An asbestos shoe, sold by the manufacturers of the sanders, absorbs the shock when the extra thickness strikes. A temporary soft shoe can be made from heavy cloth such as furniture webbing. Cut it to the length and width of the metal shoe it replaces. Either a temporary or a factory-made soft shoe should be used only for finishing work after the rough sanding has been done with the metal shoe in place.—James B. Leeth, Cullman, Ala.



# Cuts Circles from 3/1" to 12"

THE McKelvey hole and circle cutter handles metal up to %" thick and fiber, wood, and plastic up to 1%". By adjusting the rake of the cutter, noise and chatter are minimized when working on materials of varying hardness. Flat-tip screws secure the various parts, the pilot drill being pressed firmly against the side of the cutting arm. It takes any %" cutter and has a height of 2%". The attachment fits any standard drill press and is priced at about \$8 by the Sunset Equipment Company, of Los Angeles.

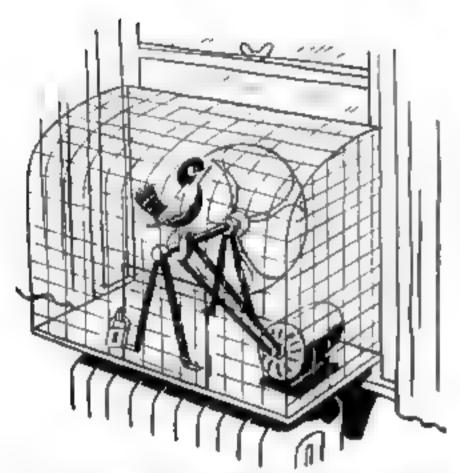
# Solder Subs for Tubing

I NEEDED a pair of manifolds for a model of a World War I airplane engine and couldn't get copper tubing of the proper size. Using wire solder, I bent it to the shape shown here. Then it was carefully coated with graphite



and copperplated (PS, Dec. '47, p. 213). After filing through the copper at one end, I melted out the solder core by heating it in a gas flame. Before copperplating, it's necessary to coat lead-base metals with graphite. Otherwise, a soft, spongy coating of copper is likely to result. If the tubing you want to simulate needn't be hollow, you can carve it of wood and then copperplate it. —Freddy Mitchell, Simsboro, La.

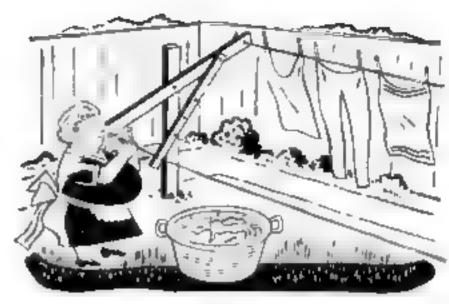
# What's Your Ingenuity Duotient?



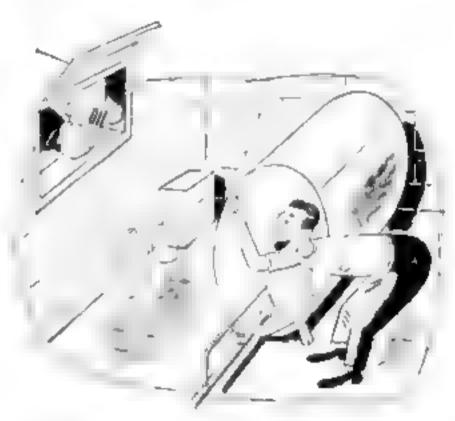
Fan Gets the Bird. Now that winter is coming on, I've sublet the window-fan cage to the canary, after first cutting a door in the screen. He likes the new accommodations so much that I'm wondering what will happen when his lease expires next spring and he must return to smaller quarters.—M. H. Bates, Montgomery, Ala.



Shelling peas for our deep freeze is a production-line operation now. We use a clothes wringer. The peas are packed in ice to make them firm. Then they're fed into the rollers blossom ends first. As the rollers take hold, the other end of the pod is pinched, and the peas come popping out.—Ruth R. Smith, Brookline, Mass.



Be Kind to the Little Wife. If your wife is short, this rig will enable her to reach the clothes line and at the same time hang clothes high off the ground. Install the cross bar so it pivots easily, and drill a series of holes in the diagonal brace. Mrs. Four-by-Five can then lock the line at the desired height with a pin through the brace.—Hattie H. Holt, Springfield, Ill.



It's Oil Right. To keep from running out of fuel oil, I tapped a hole in my tank 7" above the original feed line. Then I put in a pipe nipple and ran %" copper tubing to the regular feed line beyond the valve. With the valve shut off, my furnace gives me several days' warning before I really run out of oil.—E. LaCross, Iron River, Wash.

Have you pulled off a smort one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. If doesn't matter if it's wacky—if it works. Use gavernment postcards only. Contributions cannot be acknowledged or returned.



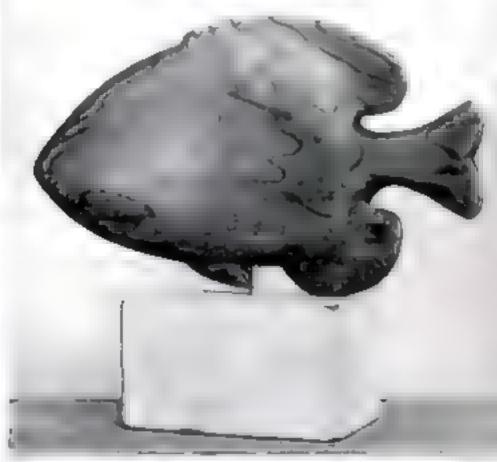
After fish is sketched on block of wood, waste stock is cut away with a saw. First shaping of the body is done with large gouge. Cuts are made partly across and partly with grain.



Body is chiseled to a rough shape and then finished with gouges and rasps. Tail and finiare separated with a rattail file. Note the hand-fitting tool handles Fitz-Gerald made himself.



Starting with coarse-grained paper, tool marks are worked out. Final sanding is with 3/0 paper. Strokes follow line of object and are not necessarily with the grain.



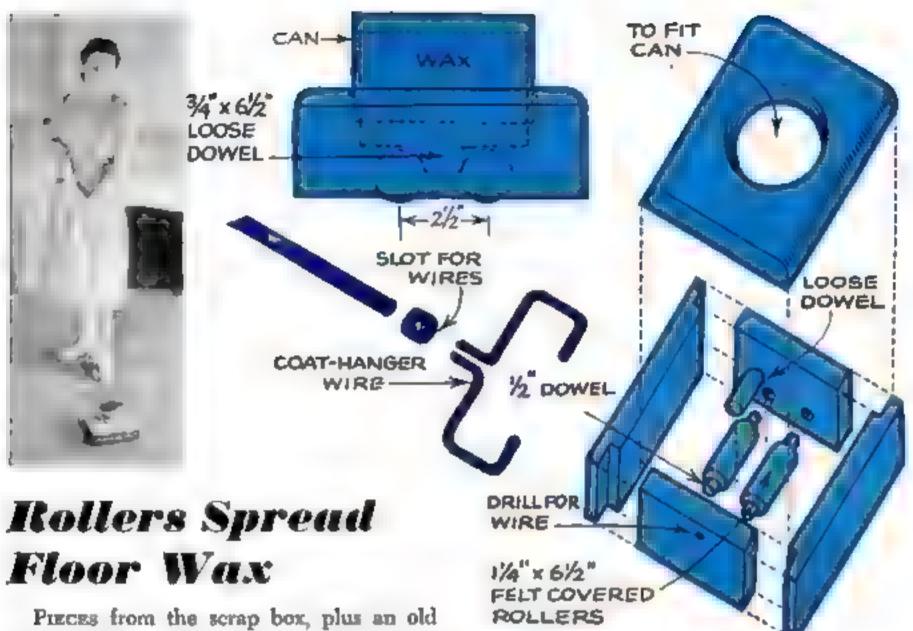
Finished work is mounted on an alumnum peg set in a block of stone. Wood is finished with two coats of shellac cut 50 percent with alcohol. Wax polishing completes the job.

# Cherry Grain Forms Fish Fins

RIPPLING as though viewed underwater, the wood gram in this carving is a basic part of the design. Note how the gram lines end in the spines of the dorsal fin. Clark Battle Fitz-Gerald, Kirkwood, Mo., commercial artist who carved this perch from cherry wood, says he sometimes spends as much time studying grain structure as he does in

carving. His favorite woods are walnut, cherry, and osage orange.

He uses the usual woodworking tools—saws, chisels, gouges, rasps, and files to do his carving. Fitz-Gerald also made the mallet and the handles of the other tools. The mallet, of osage orange, is so tough that nails can be driven with it.



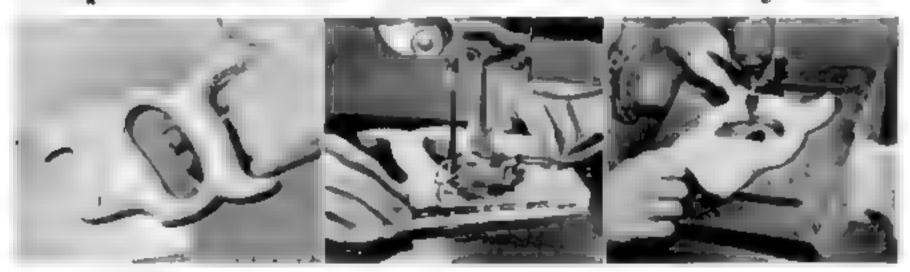
Pieces from the scrap box, plus an old broom handle, provided the parts of this applicator that holds a can of paste wax.

Dimensions for the rollers are given in the drawing. Build the box to conform to them. Cut the hole in the top for a loose fit around the can. The two larger rollers are covered with felt while the smaller one is left bare. This free roller acts as a stabilizer, bearing most of the weight of the wax and preventing the felt-covered rollers from taking up too much wax. Loosen the wax from the

can before placing the inverted can in the top of the applicator. Leave the can in place as a protective covering for the wax.

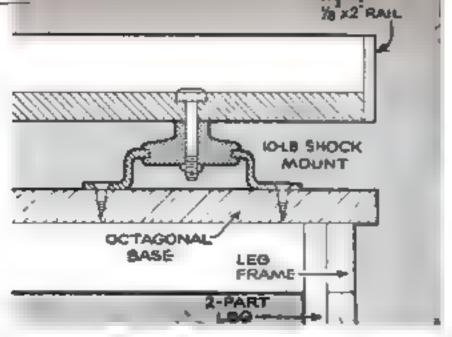
I turned the rollers on a lathe. However, dowels or lengths cut from a rolling pin will do just as well. The wire bracket was bent from a heavy wire coat-hanger and the ferrule taken from an old mop.—Bernard Cohen, Toronto, Canada.

# Replacement Saw Handles Cut from Plywood



You can duplicate a favorite saw handle by cutting a blank from glued-up scraps of %" plywood. After gluing four pieces of hardwood plywood face to face, trace the outline of the new handle from the old one. Scrollsaw to the outline (center photo above)

and then use rotary files chucked in a drill press to round the edges. Tilt the table at various angles to shape the edges. Smooth the work with sandpaper. Use a ripsaw to cut a slot for the blade and drill for mounting screws.—E. M. Love, Palmdale, Calif.



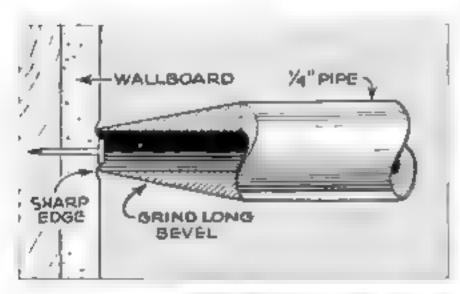
### Table Holds Portable Washer

AFTER repeated efforts to buy a suitable table for my portable washing machine, I decided to build one to my own specifications. Here it is.

An octagon shape was adopted to save space and avoid sharp corners. Legs were built up of two pieces. This made it unnecessary to cut a rabbet for the leg frame. An octagonal shelf mortised into the legs provides rigidity for the structure

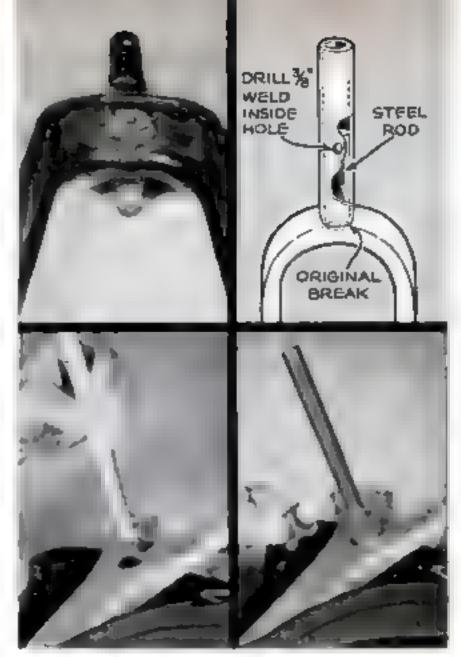
Shock mounts under the table face eliminate vibration and rubber pads on all

the legs reduce the "walking" action. Instead of forming %" wood around the top as a rail to retain the washer, you could use sheet metal.—W. L. Taylor, Washington, D. C.



# Tool Cuts Wallboard Free

This tool makes it easy to remove wall-board. It's made by grinding a long bevel on one end of a short piece of k" pipe. When the tool is set over a nail and hammered, the sharp edge cuts through the wallboard, freeing it from the nail. The board can be nailed back at a different spot.—John H. Dunnewin, Grand Rapids, Mich.



# Hints on Repairing a Tricycle

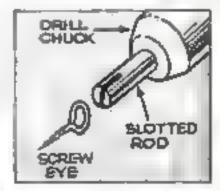
Some tricycles aren't as well built as they might be. As a result repairs are often necessary. The procedures I followed in two such jobs may help others.

First, the fork broke at the point where the neck joins the wheel arms. Since the neck is just tubing, it soon broke loose again when welded. To strengthen it, I pushed a length of close-fitting steel rod into the tubing. Then I welded inside two X" holes drilled in the tubing, around the original break, and also underneath.

When the seat column broke loose from its metal plate, as in the lower left photo, I decided against welding. Instead, I cut the head from a carriage bolt of the proper diameter and clamped the plate between nuts.—A. C Kubitz, Millbrae, Calif.

# Slotted Tool Sets Screw Eyes

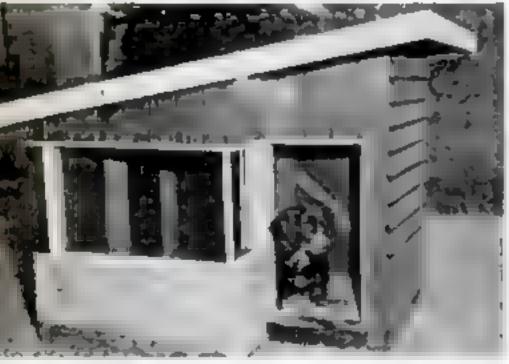
This handy tool saves time and work in driving all kinds of screw eyes and hooks into wood. Make it by cutting a 5" length from X" steel rod, Slot the end with a hack-



saw and widen the slot by forcing the legs apart with a screwdriver. Chuck the solid end of the tool in a brace or drill.



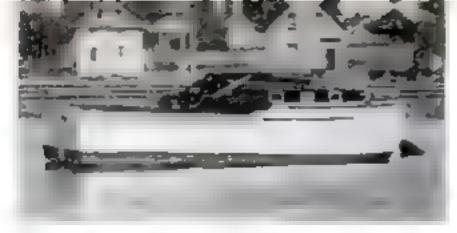
Hot Rod, 1911 Model. The prototype of this miniature, a Ford Model T Torpedo roadster, was a snappy number when it bounced over the roads of those days. Built by Arthur Salmons, of Hynes, Calif., the model has a dummy engine.



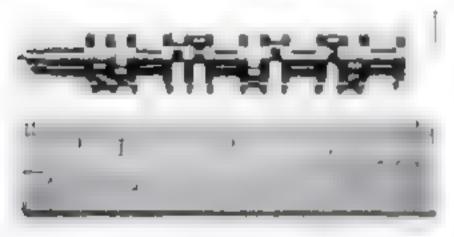
No Housing Shortage Here. A young Cocker spaniel poses in the doorway of a modern doghouse designed and built by Reginald Odegaard, of Burbank, Calif. Windows are heavy, shatterproof glass. The stonework consists of small flagstone chips laid individually in cement. Redwood siding makes up the remainder of the kennel.



Builds Lathe to Build Motor.
M. F. Shea, a retired telephone maintenance man of Drexel Hill, Pa., first built a watchmaker's lathe and then used it to turn all the screws for this three-pole motor. The thumbnail-sized midget whizzes on 3 volts. Commutator segments are German silver, brushes real silver.



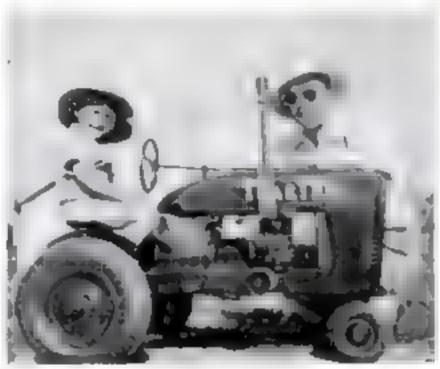
Roat Built from PS Plans. This 17' cabin cruiser was built by C. A. Sherwood, a dental technician of Moncton, N. B., Canada. Spruce planking was used on the hull and marine plywood for the cabin roof. A 6-hp, inboard engine powers the craft. About seven months of spare-time work went into building the cruiser.



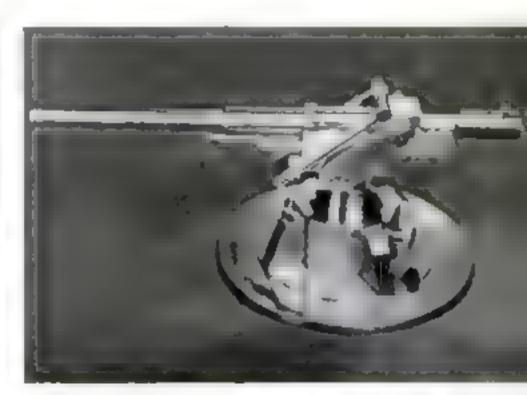
Crankshaft 3 1/2" Long. From a piece of steel %" in diameter, Henry Juerin, of Elberon, N. J., turned this tiny crankshaft. It has five main bearings and is designed for an eight-in-line engine that Juerin built. The ruler shows how small it is.



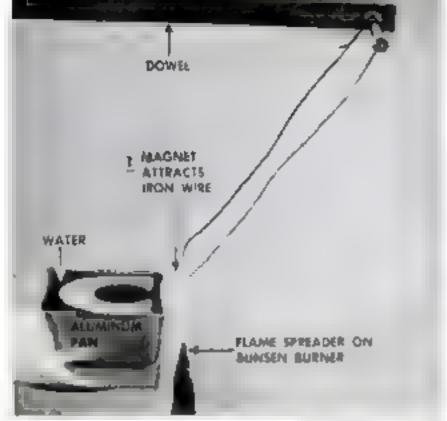
Engine Displaces .05 cm. in. Designed as power plants for free-flight model planes, these little Diesels turn up 11,000 r.p.m. with a propeller and 20,000 r.p.m. if the prop is replaced by a small flywheel. Elmer Larsen, of Seattle, Wash., a Boeing Airplane Company machinist, builds them in his spare time and sells them for \$10 each. They burn a mixture of methanolalcohol and castor oil, the latter furnishing the lubrication. A teaspoonful of fuel runs the engine about a minute. With the exception of the glow plug, Larsen makes all the parts of the engines in his basement.



Tractor for Kids. A 2/3-hp. engine powers this miniature tractor that S. C. Matula, of Boyceville, Wis., built for his youngsters. Since the tractor doesn't have any farm work to do, it's used principally to tow the coaster wagons of neighbors' children. It'll pull four wagons loaded with 12 kids.



Model AA Gun Fires Blanks. No castings were used in this model 75-mm. antiaircraft gun. James Marini, of Brooklyn, N. Y., used a lathe, shaper, and drill press to fashion the parts of steel. It fires .22-cal. blanks. The barrel measures 13" and can be elevated 80°. When fully elevated, the gun measures 14" high



Iron loses magnetism if heated to 740° C., but regains it on cooling slightly. Simple magneto



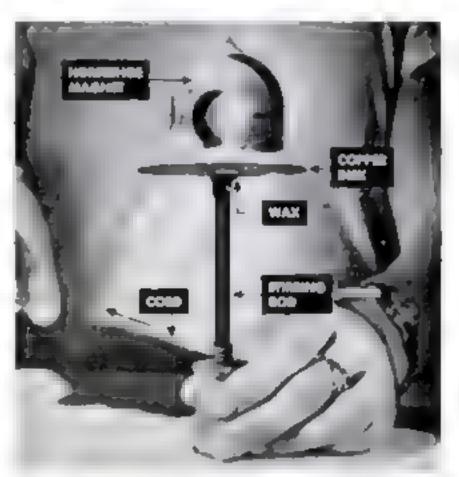
heat engine above makes use of this. The wire swings back and forth as it heats and cools.

# Magnet Magic

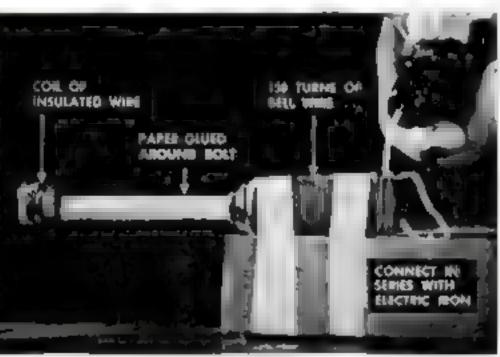
M AGNETIC materials sometimes act in unexpected ways. Extreme heat, for instance, robs iron of magnetic response, as you can see above. Submerge the magnet in water to prevent overheating.

Copper isn't usually considered magnetic, but glance to the right. Here, the spinning disk acts as a sort of electric generator. Eddy currents set up in it produce a corresponding magnetic field that drags the magnet around with the disk.

In setting up the "gun" below, anneal the bolt before winding. Join together the ends of the coil projectile. AC passing through the gun winding sets up a magnetic field in the bolt, and this in turn creates a field in the projectile. Since like poles face each other, the coil is thrown off the bolt.



Electric currents set up in copper disk cause horseshoe magnet to turn same way as disk.



Magnetic gun "fires" coil projectile by repulsion. Coil consists of 75 turns of No. 24 insulated wire. It slaps freely over bolt barrel. Switch on current and coil fises off as above.



Nail is magnetized temporarily even though it doesn't touch magnet. This is called magnetization by induction. Move the nail slowly away and tacks will fall off as it loses magnetism.



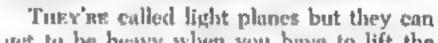
# Plastic Flowers Won't Wilt

THE floral group pictured above was cut and bent from seraps of Lucite®. The stem is a section of "" rod and the leaves are random cuts of 1/16" stock. Follow the

pattern for the flower, cutting it from the same stock as the leaves. Then heat it, lay it over the top of a small glass, and push the center down. The base is a disk, heated and formed in a shallow bowl. Cement all parts together .- P. E. Hart, Manhattan, N. Y.

# Gas Shut Off Automatically

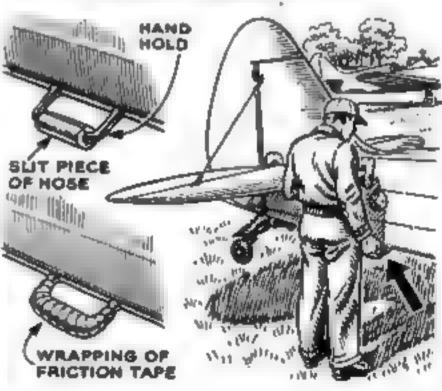
ALL gas used in this stove, including that for the oven and pilot light, passes through a central valve. This valve is controlled by a bellows-type thermostat just below the pilot light. As long as the pilot light burns, the master valve remains open. If the pilot is accidentally blown out, or if gas pressure temporarily fails, the thermostat shots off gas to all burners. A match is held under the thermostat to relight the pilot. The inventors are Lewis R. Kinsey and Henry F. Klein, both of New York City.



Cushions Plane Lift

get to be heavy when you have to lift the tail around. This is especially noticeable if you have to move the ship any distance, since the metal lift will cut into your hand. I padded the one on my plane with garden hose. After slitting a short piece of hose, I conted the inside of it with gasket shellac. A good glue would do just as well. Then I slipped it on the lift and finished the job with a couple of wrappings of friction tape. -Stewart Rouse, Knightstown, Ind.





OCTOBER 1949 24

# Concrete Mixer Cooks a Meal Too

FROM mixing concrete to cooking a meal sn't so far fetched when you consider what else this versatile machine does. It'll also sift fertilizers, soils, or aggregates, and

spray paint or insecticide.

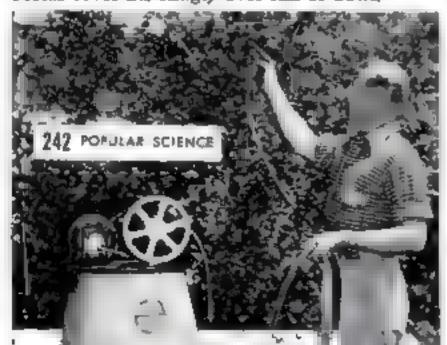
The 90-lb. Whirl Barrow<sup>®</sup> is a multipurpose unit designed for yard and farm work. Stip a screening attachment into the barrel and it becomes a sifter. Another attachment is a K-hp, motor and a pump, enabling you to spray paint or to cover trees and shrubs with chemical solutions. Then there's the cooking, A grated pan for coals and a spit can be fitted in place. A screen rack may be laid over the coals to keep food warm and meats can be roasted on the spit.

By pressing the U-shaped stirrup with your foot, the bowl can be tilted to any of five positions. When pressure on the stir-



Frame is lightweight welded tuhing. Large tire permits easy rolling over soft or rough ground. Bowl holds 1% cu. ft. of concrete.

Now it's a sprayer. A %-hp, motor drives pump that raises insecticide or paint from the tank. Metal cover fits snugly over rim of bowl,





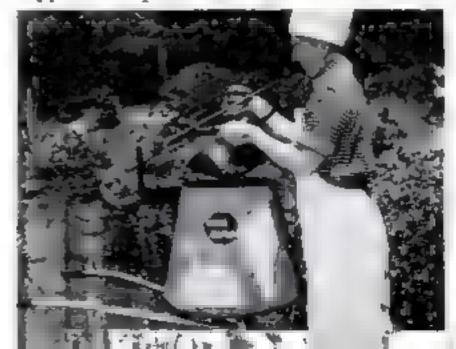
Rotating offset handle turns bowl on a ballbearing shaft that extends from the base. No other support is required

rup is released, a spring-loaded pin locks the barrel in position. For stability in rolling the barrel is locked to prevent rotation by pressing a lever in the base. Twenty-five gallons of liquid or 1% cu. ft. of concrete may be mixed. The mixer is made by Magna Engineering Corp., San Francisco.



Whirl Barrow® also sifts soil, fertilizer, and other materials. Circular screen first is inserted in mixing bowl and handle turned.

When day's work is done, mixer quickly becomes a charcoal broiler. Spit also may be slipped into place and used to roast meats.





# Twin-Cylinder, 2-Cycle Engine Drives Bike



PLENTY of power on hills plus economical operation are two of the features claimed for this twin-cylinder bike engine by the makers, Jack & Heintz Precision Industries, Inc., of Cleveland, Ohio. The unit includes an autotype, multiple dry-disk clutch, twist-grip controls, and a large combination fuel tank and utility compartment. Deep finning permits the engine to idle safely without overheating. Center-flow carburetion assures a steady flow of fuel even when the engine is tilted. A compression release contributes to starting ease and rapid deceleration. The unit comes complete, ready for installation.

# Keeping the Home Shipshape



Store bath toys in net bags, the kind citrus fruits come in. The bags can be hung up out of the way and the toys will dry quicker because air can circulate around them.



Needles may be stored in a lipstick case. Stick the needles in a cork that has been pressed into the case. Turning the bottom lowers the needles so the cap may be put on.



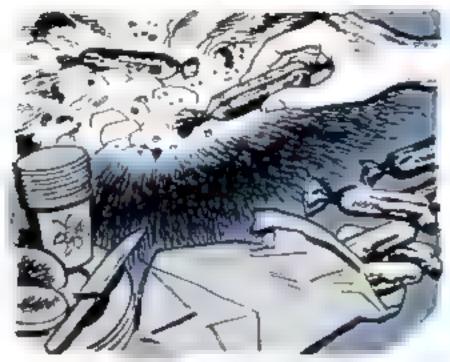
Valuable papers that must be held temporarily in the home while awaiting transfer to a safe-deposit box may be stored in the refrigerator. It affords some fire protection.



When mounting curtains on a stretcher, you won't risk pricking your fingers if you use a fork to press each section of curtain into place on the pins of the frame.



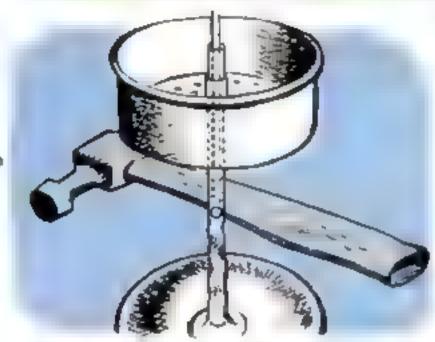
For a sickroom table, cut holes in the top of a small cardboard box and sit bottles of medicine in them. It'll prevent bottles from being upset and will keep the table neater.



Weapped individually in aluminum foil and cooked in a bed of coals, wieners retain their more and remain perfectly clean. Skins are not pierced as on a stick or fork.



To keep dust out of closets, tack felt weatherstripping to the sill or inside the bottom of the door. If tacked to the door, be sure the stripping touches the floor.



Bent or kinked percolator tubes can be straightened by inserting a tight-fitting bearing ball and forcing it through with a dowel. Tap the end of the dowel lightly.

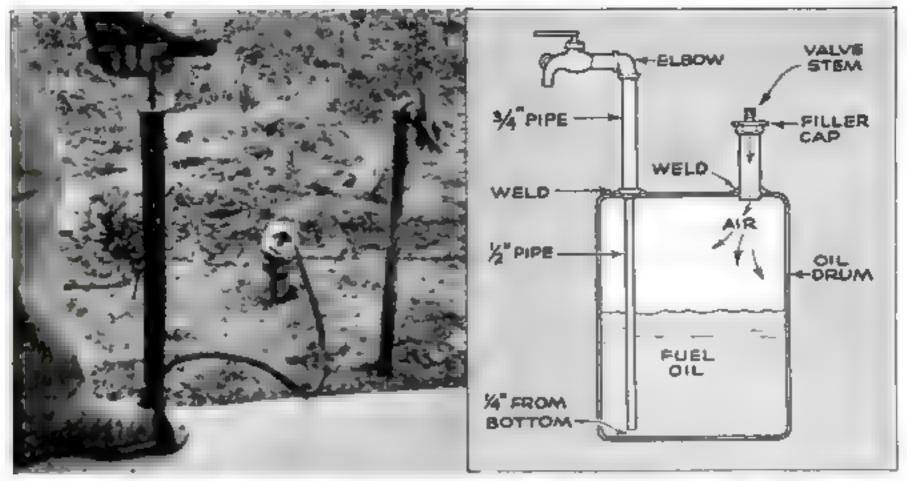


You can add to the usefulness of table and floor lamps by mounting an outlet on them so other appliances may be connected. The outlet may be set in if the base is of wood.



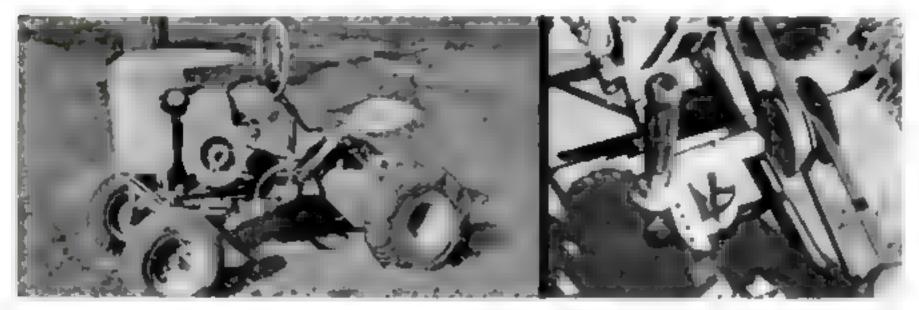
When moving, pack small amounts of staples in a separate box. In your new location, you'll

have supplies for the first few meals in the small box without unpacking large containers.



# Air Lifts Fuel from Tank

AN UNDERGROUND storage tank, operated by air, can be made from a seamless, galvanized oil drum. Use one of 50- to 200-gal, capacity, with both openings at one end. Replace the filler cap with a pipe 6" longer than the depth the drum will be buried Other connections are shown in the sketch. Solder a tire valve stem into the filler cap, but remove the valve core. A few strokes of a tire pump forces liquid out of the tank. To prevent rust, coat the tank with asphaltum paint—Clinton R. Hull, Costa Mesa, Calif.



# Scooter Parts Make Tractor

Pictures above is a small garden tractor that I built from parts of an old motor scooter and other pieces of scrap metal. It will pull an 8" plow in heavy soil and does

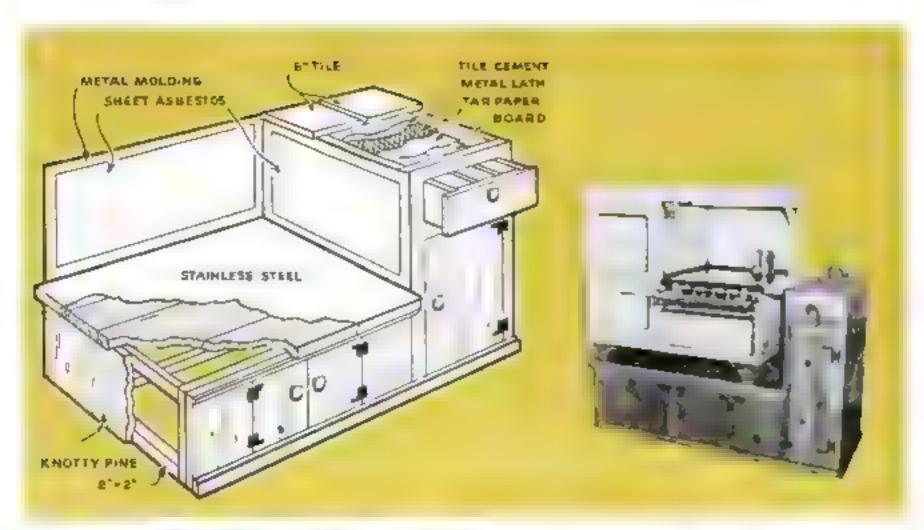
a lot of other odd jubs. The variable-speed V-belt transmission, shown in the photo at right, can be shifted while the tractor's in motion. The final drive is through a 24-to 1 transmission that I bought at a war-surplus sale. Clude Clumer, Lincoln, Nebr.



# Old Tire Holds Pest Poison

Poisoned grain may be safely set out in old auto tires. Pets and birds can't get to the grain, yet field mice can. Slit the side of the tire that'll be next to the ground so any rain water may drain out. Spread the grain around inside the casing and raise one side with a small rock to give mice an entrance.—John Krill, North Lima, Ohio.

246 POPULAR SCIENCE



# Cabinet Utilizes Waste Space Under Old Range

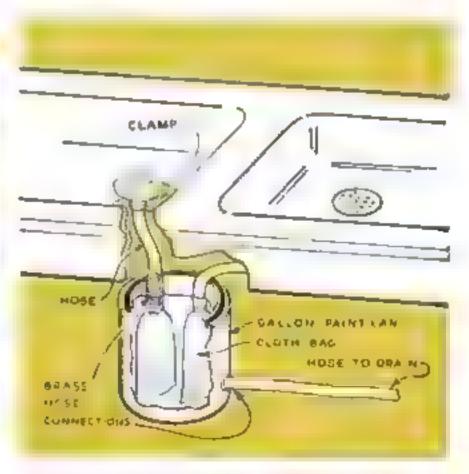
THE cut won't like it, but here's a way to make better use of the space below one of those old stilt-type kitchen ranges.

Cut off the legs and set the range on a neat cabinet like the one above, which was made of knotty pine on a 2" by 2" frame. There's plenty of space below for pots and pans, while long-handled utensits can be hung in the tall cabinet. Cutlery goes in the drawer at top.—Ht Sibley, Nuevo, Calif.



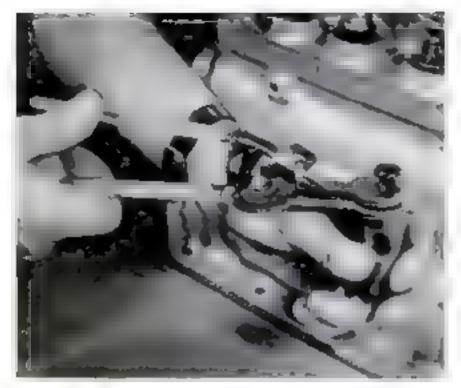
# Vanity Chair Mas Own Drawer

A THREE-SECTION sliding compartment in the vanity chair above provides storage space for hose or handkerchiefs. The chair and vanity in the background are part of a new line of Monogram® furniture offered by the Mengel Company, of Louisville, Ky. The drawer pulls are designed so that your initials, in gold, can be slipped in.



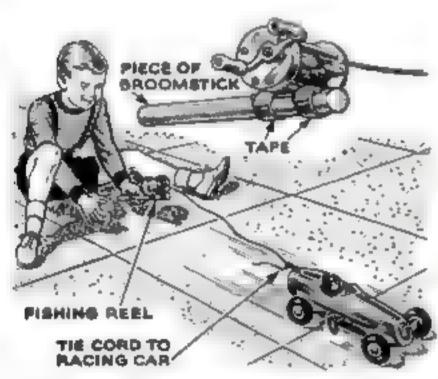
# Trap Keeps Sink Drain Clear

In use for a year on my house trailer, the improvised drain trap above has worked like a charm. Two brass hose connectors were soldered to holes in the can lid and a third in the side. Cleaned regularly by prying off the can lid and putting on new cloth bags, the trap keeps the drain from clogging.—F. H. Londen, Bellflower, Calif.



# Tool Speeds Tappet Setting

This combination tool, designed by W. C. Herst, a master mechanic of Dubuque, Ia., is said to halve the time required to adjust auto-engine tappets. As shown in the photo, the tool holds the tappet body and the lock nut. The lower leg of the tool has a feeler gauge held to it by metal straps so the gauge may be pushed forward. With one wrench holding and with the feeler gauge in place, the other wrench is used to adjust the tappet. Once set on a tappet, the tool will remain there. Engine vibration can't shake it off. In the photo, a dummy tappet is being used for demonstration.

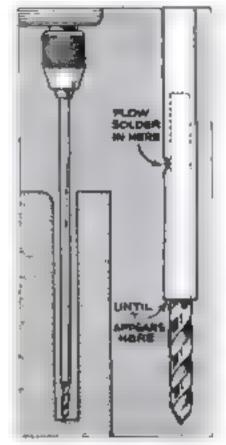


# **Old Reel Retrieves Toy Auto**

AN OLD fishing reel, taped to a section of broomstick, is a quick retriever for rolling wind-up toys. After the toy has run its distance, the child can reel it in. If you don't have an old reel, some surplus-property stores sell the small, low-priced reels that were included in survival kits during the war.—Walter B. Weber, Angola, N. Y.

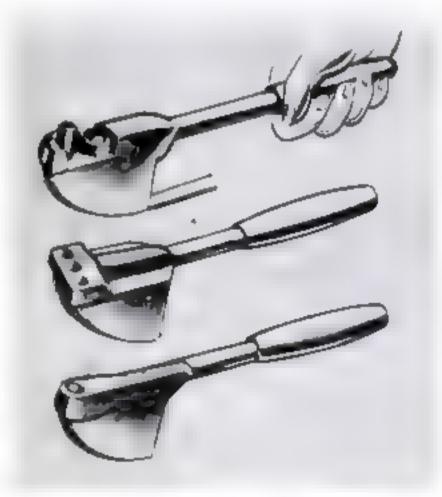
# Brass Rod Extends Drill

Here's a kink I use to get a drill into spots where there's no room for the chuck. As an example, say a No. 50 hole has to be drilled in a valley about 5" deep, as shown in the sketch. In one end of a 6" length of brass rod. drill a No. 50 hole deep enough to take about three-fourths of the drill. File a notch %" from the end of the rod. Put the shank of the drill in the hole and flow solder in the notch until it appears



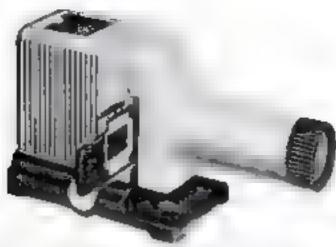
at the end of the rod. You can save these extensions until you have a set, or you can remove the drills by heating the rod until the drill can be pulled out. Fine sandpaper will clean bits of solder off the shank of the drill.

—Herbert Pfister, Bronx, N. Y.



# **Tools Bend Small Tubing**

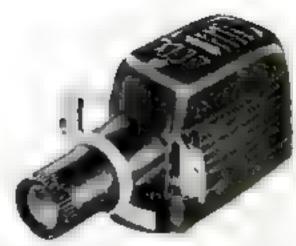
KNOWN as Bob's Tu-Benders<sup>®</sup>, these three tools handle bending jobs on tubing from %" to %" o.d. They're priced from \$2.50 to \$4.50, depending on the type, by the distributor, Keiner Machine Products, of Los Angeles. According to the company, the tools can quickly be slipped on or off tubing and there is no chance of kinking.



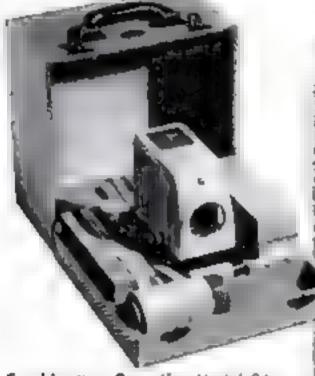
Kodoslide Projector, Model 2A -- Lumenized Kodak Ektonon 5-Inch 1/3.5 Lens. Adjustable till control, \$47.50.



Kodaslide Projector, Master Model— 1000-watt lamp. Superb aptical system. \$181 to \$295, depending on lens choice.



Kodaslide Projector, Mudel 1A -- Projects bright images up to 7 feet wide. Efficient, yet inexpensive, \$27.50.



Combination Case (for Model 2A) Haids Kadaslide Projector, Kodaslide Changer, lens, Kadaslide Sequence First or Kadaride File Boxes, \$15

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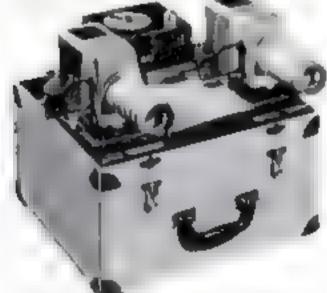
Projecta Case (for Model 1A)-For corrying, Haroge, and projection, \$10



Kodoslide File Box - Protects 140 cordboard slides, 55 gloss slides, keeps them organized, \$1.15



Kodoslide Table Viewer-Screen, projector, and slide changer all in one unit. \$95.



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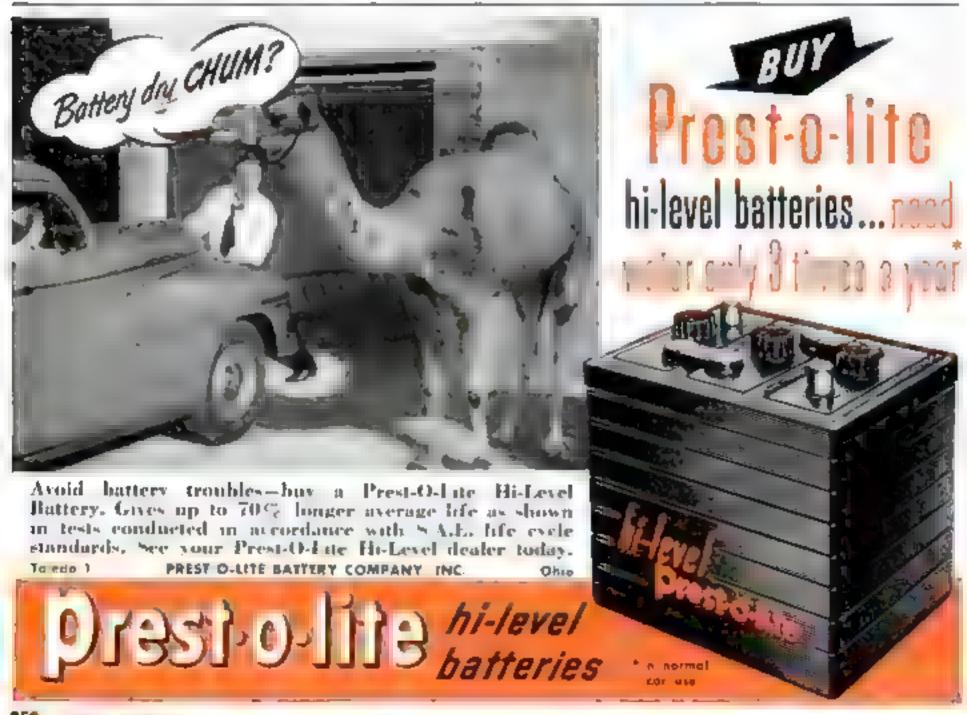
# **Device Doubles Pattern Guides**

To put dressmaker's marks on two pieces of cloth at a time, just ship this new plastic device under the second layer. When you mark with a pencil through the regular pattern perforations onto the top layer of cloth, the bottom layer is pressed against a coated transfer sheet, contained in the device, and is marked by it. Sewing Products Co., of Cincinnati, Ohio., makes the marker.



# Ruler Simplifies Sewing

You can mark guide lines on fabric right through this new ruler, made of transparent, rigid, Vinylite® plastic. It has parallel slits at varving intervals, giving different widths for cutting bias strips, belts, and buttonholes. Manufactured by Sewing Products Co., of Cincinnati, O., the ruler is available at department and notion stores, and sewing centers. It costs \$1.00.



# Before anti-freeze goes in clean out rust and scum



Clean out rust with

### DU PONT COOLING SYSTEM CLEANSER

Don't put anti-freeze into a rust-clogged radiator. Clean out the rust, scale and scum now before winter sets in. Just pour a can of DU PONT CLEANSER into your radiator, run the engine for 30 minutes or more, then drain. That's all! It cleans thoroughly without reverse flushing. It's safe, sure, and easy to use.

Keep out rust with

## DU PONT ACID AND RUST INHIBITOR

After cleaning out the radiator, you can keep it free from rust all season by pouring in a can of DU PONT ACID AND RUST INHIBITOR. It retards rust formation, and keeps out acid, too.

Avoid leaks and loss of anti-freeze

### DU PONT COOLING SYSTEM SEALER

You can stop leaks quickly and securely—and help to prevent radiator leaks in the future—by pouring in DU PONT COOLING SYSTEM SEALER. It will not clog the radiator or harm hose or metal parts.

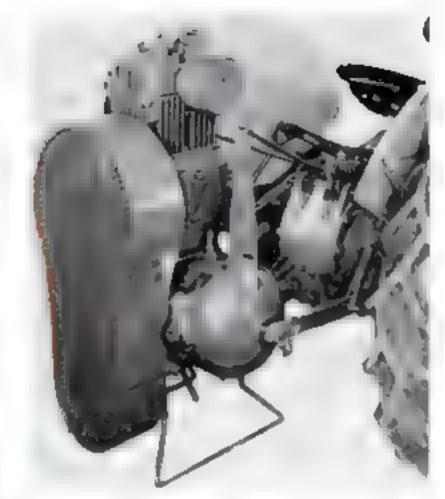
Rust-clogged radiators waste anti-freeze ... cause trouble and expense



Satter Things for Better Living ... Through Chemistry

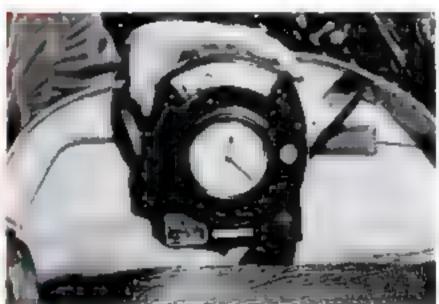






### Tractor Runs Compressor

Just hitch this portable air compressor to the power take-off of a tractor or a jeep, and you'll get the compressed air you need at a working site without bringing in a heavy machine requiring its own engine. Used to run air-operated equipment, such as lifts, hoes, and shovels, or for painting and spraying, the easily attached compressor comes in two sizes. It is made by Miller-Robinson Co., of Los Angeles.



### Device Records 'Cycle Test

A HELPING hand for motorcycle test riders, this tachograph automatically records the speed, time, and distance a vehicle travels. Thus it lets the rider pay more attention to the motorcycle's actual performance. Test conditions are continuously recorded as wavy red lines on an enclosed chart. An engineer of Harley-Davidson Motor Co. used this method of experimenting with a motorcycle in recent tests.





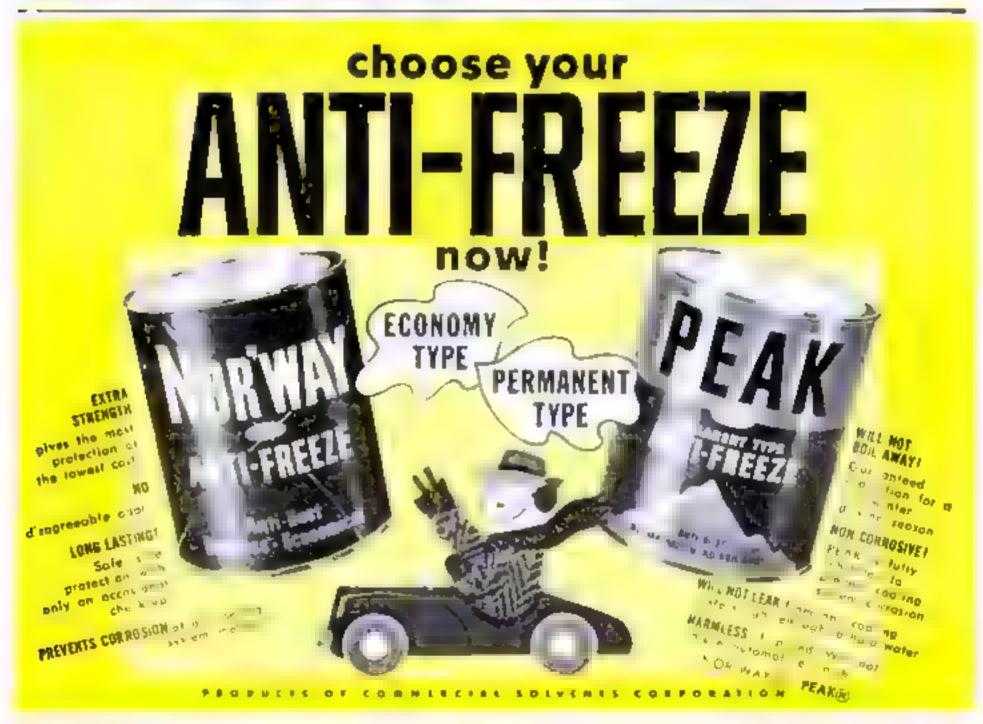
### **Cutouts Dramatize Records**

MEMBERS of the bedtime-story set can now act out such favorities as "Golddocks" and "The Three Little Pigs" as they hear them on records. Each dramatization, on 12-m., durable Vinyhte® records, is accompanied by colored cardboard cutouts of the characters and stage props. Made by Family Games, San Francisco, they sell for \$2.95.



### Music Soothes Commuters

The circular fixtures on the ceiling of this trackless trolley in Circumath are radio loud-speakers. Eight of them in each trolley are connected with an FM set under one of the seats. The system was installed free by Transit Radio, Inc., as an extra outlet for regular programs sold to advertisers. It carries no soap operas or singing commercials.



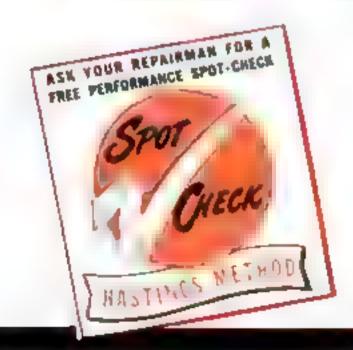


OIL-PUMPING is a symptom of piston ring wear. And by the time you notice it, your rings will be pretty badly worn. They should be replaced immediately.

Hastings Piston Rings are designed especially for replacement service . . . So ask for Hastings—the replacement ring that stops oil-pumping, checks cylinder wear and restores performance. It's the best money you can spend on your car.

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# HASTINGS

STEEL-VENT PISTON RINGS

"TOUGH ... BUT OH SO GENTLE"

TOUGH on oil-pumping — GENTLE on cylinder walls

# Standard for Home and Industry



Koster Solder makes all motol repair jobs easier



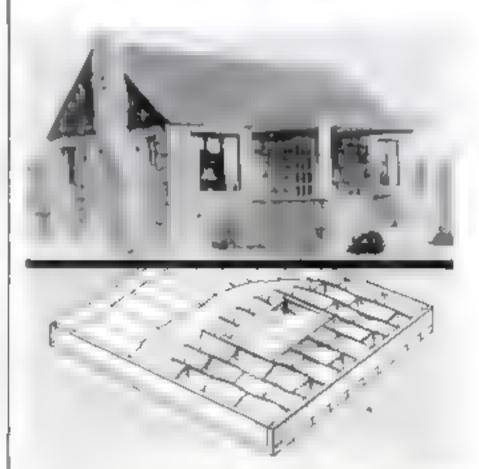
### KESTER SOLDER COMPANY

4201 Wrightwood Avenue, Chicago 39, III.
Factories also at
Newark, New Jersey - Brantford, Canada



### Magnetic Roller Sweeps Metal

Picking up stray bits of metal from floors and roads or out of liquids and powders is simple with this sweeperlike magnetic roller. Called the Magnetool<sup>0</sup>, it has 50 percent more pick-up power than previous models. The inset shows how particles are removed by a wiper ring that pushes them to a non-magnetic spot where they fall off.



### Cement Blocks Look Like Stone

Now you can make concrete building blocks that look like natural cut stone. They are east in irregular shapes that fit together. Partitioned wall forms are first laid out with spaces for doors and windows (lower picture). Then concrete is poured in and covered with crushed Imistone<sup>®</sup>. When hard, the blocks are cemented together.



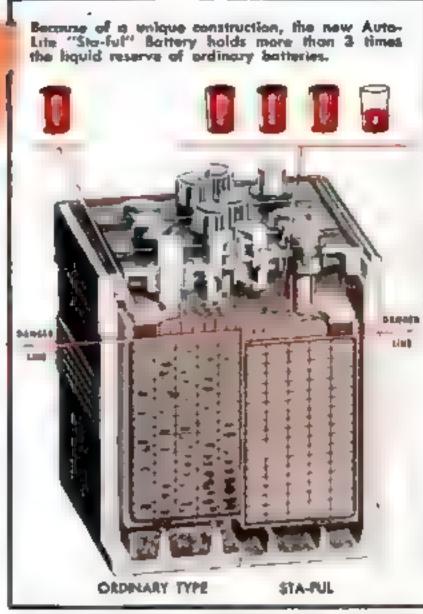
# **AUTO-LITE Sta-ful** BATTERY...needs water only 3 times a year\*

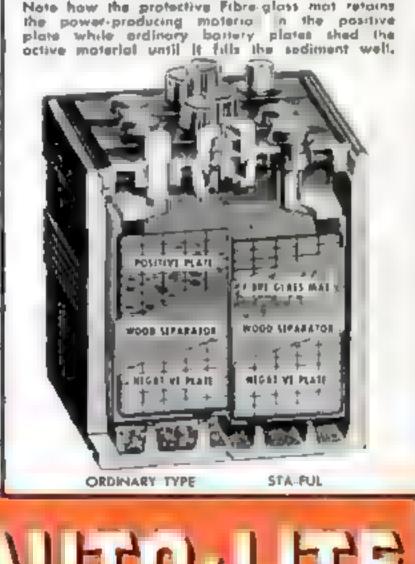
A revolutionary new development, the Auto-Lite "Sta-ful" Battery, protects you against a major cause of battery failure . . . damage to plates due to liquid loss. This new "Sta-ful" Battery design permits a liquid reservoir with 3 times the capacity of ordinary batteries . . . keeps plates fully covered and active months longer in normal car use.

In addition, "Sta-ful" has Fibre-glass mats to hold the power-producing material in the plates for longer battery life. To get more for your battery dollars, replace with an Auto-Lite "Sta-ful". Money cannot buy a better battery.

AUTO-LITE BATTERY CORPORATION Toledo 1









Full  $Y_2$ -inch driff capacity, removable side handle for close-quarter driffing, weight complete only  $\Psi$  pounds. U. L. listed

# ZEPHYR SERIES 1950 4

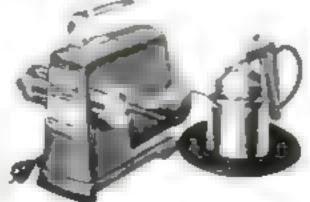
Model No. 1930-G......\$1995 (with Jecobs Geer Chuck)
Weight complete, only 3 pounds,

Weight complete, only 3 pounds, 2 aunces. The speed, power, and small size make it the ideal power tool, have

tize make it the ideal power tool, handy to use as source of power for driving drill attachments for disc sanding and polishing, cleaning point brushes, grinding and sharpening tools, buffing, removing cost and point with wire wheel brushes, etc. A real money sever around the house, form and home shap. U. L. listed.

## EIPHYR MODEL SM-25 \$24.95

A complete electric sprayer unit with electric motor, two-cylinder air compressor, pressure equalizer storage tank, 25 to 30 pounds pres-



sure. Sproys paint unamel, lacquer, insecticides, and motheroofing tolutions. Easy to use—no spraying experience necessary for fine job on furniture, cars, radiators, etc. full instructions with every unit.

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### Lantern Has One Control

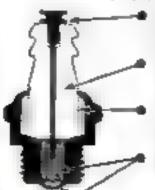
THERE'S only one control handle to adjust when lighting the new Ready-Lite® gasobne lantern above. The knob combines starting air mix, cleaning needle, and gas-line valve and is shaped so it can be set at the right point by feel in the dark. Thanks to a burner plate that deflects heat in a sideways direction instead of up, the lantern is cool to carry. A combination pump and filler plug provides a %-inch fuel opening for the lamp, which is manufactured by American Gas Machine Co., of Albert Lea, Minn.

### Sundial Time

Sun time, as shown on the sundial, starts getting earlier after December 22. In November the sundial is more than 15 min, ahead of our clocks, while in mid-February it is nearly 15 min, slow. In January the difference between sun time and clock time is rapidly changing which makes the sun seem to rise earlier.

# CHAMPION V-GLOW PLUGS

for model engines only



CHAMPION TERMINAL—assures better center electrode sea, and provides sturdier electrical connection.

champion-ceramic insulators proved dependable in millions of Champion Spark Plugs.

CHAMPION SILMENT SEAL—prevents excessive compression leakage between insulator and shell

CHAMPION "THERM-O-FLEX" CON-STRUCTION—longer element life, more dependable performance.

Follow recommendations of plug types and fuels approved by engine manufacturer.

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THE EXPERTS

These first crisp days at the tootball season should remind you that hard starting weather is just ahead, and to have your Champion dealer check your spark plugs. There's nothing like a new set of dependable Champion Spark Plugs to revitalize a sluggish and gas wasting engine. Perhaps they'll only need cleaning and adjusting—but if you find you need new ones, be sure you get Champion, America's Favorite Spark Plug for over a quarter century. CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO.

Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscost every Friday night, over the ABC network

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# NEW POWER TOOL AND WELDING EQUIPMENT BOOK

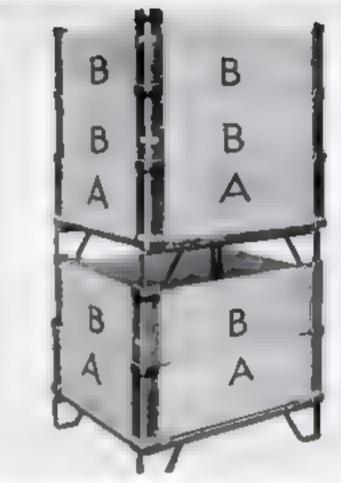
Beautiful rotogravure 52-rage book contains hundreds of Illustrations, descriptions and specifications of Wards well-known Powr-Kraft line of tools for wood and metal, and motors. Also shows the nationally-known Logan Metal Lathes, Mail Electric Saws, Burke Milling Machines, Burgess Hand Tool Kits, deluxe quality Beaver Power Tools, etc. Book leatures the popular Shopsmith, a complete 5-tool-in-1 workshop. All tools may be purchased on convenient monthly payments at Wards Mail Order Houses, Catalog Order Offices or Retail stores.

Every power tool beginner, advanced habbyist and production shop should have a copy of this money-saving catalog. Use coupon for your free copy now!

# Montgomory Ward

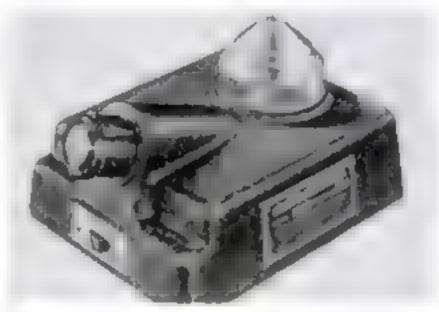
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### Units Increase Box Depth

You can have either deep or shallow boxes for holding factory materials on skids with the bottomless, hardwood units above. Unit "A," with flanged metal corners that extend beyond both its ends, fits anugly over a skid, which serves as the bottom of a container. Piling Unit "Bs," which are flanged on one end only, on top of an "A" increases a box's depth. Ironbound Box & Lumber Co., of Hillside, N. J., is maker.



### "Mike" Gauges Glass Tubes

The thickness of a glass tube—or any curved, closed, transparent material—can be measured with Opti-Mike® above. Thickness is found by placing the surface to be measured against a measuring head. Then a graduated dial is twisted until a lamp image is seen sharply focused through the eyepiece. Developed by Instrument Development Laboratories, the device measures to an accuracy of .001 of an inch.

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Handles stock up to 6 nch inch
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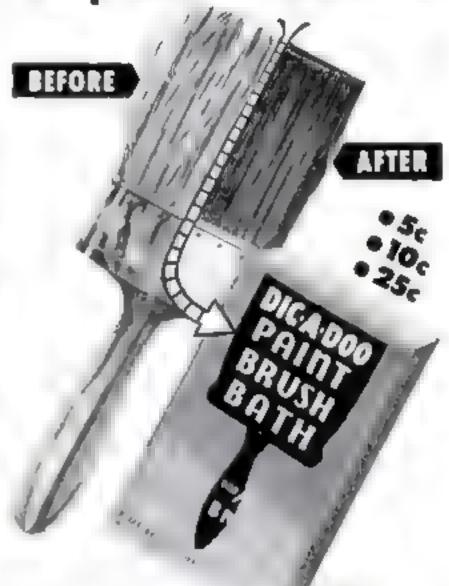
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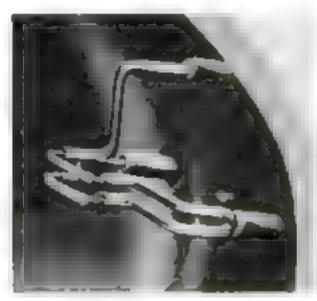
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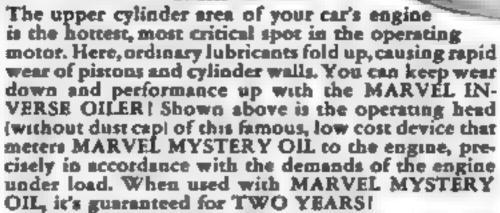
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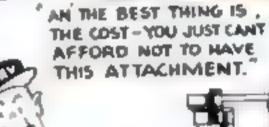


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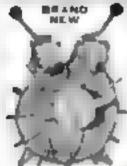
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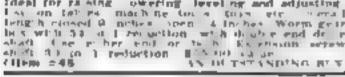
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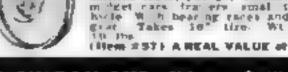
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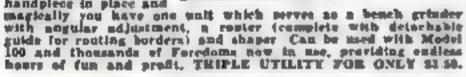
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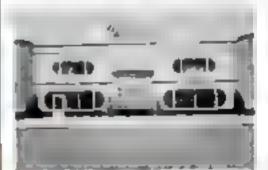


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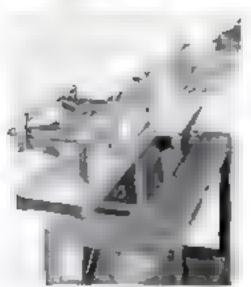
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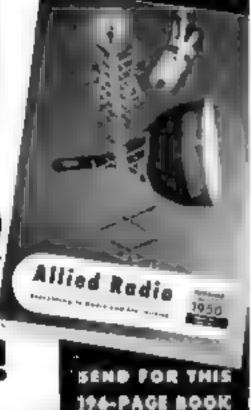
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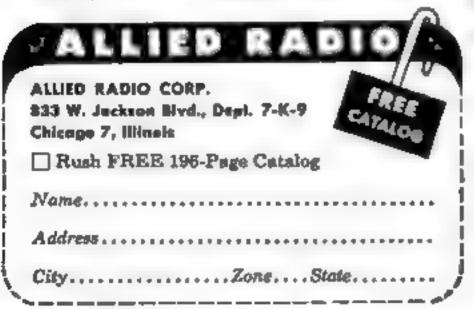


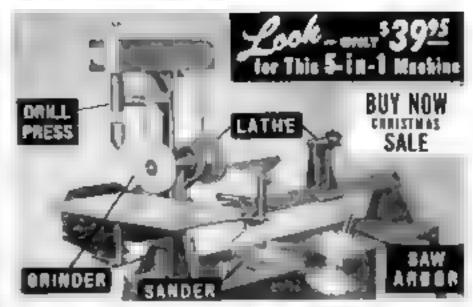
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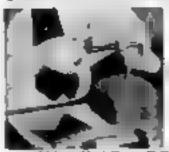
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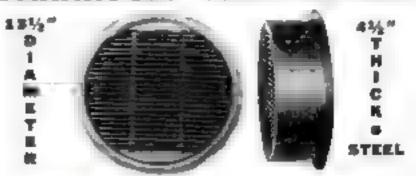
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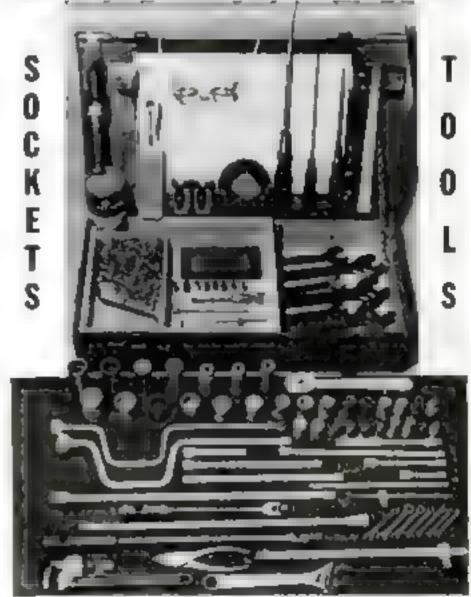
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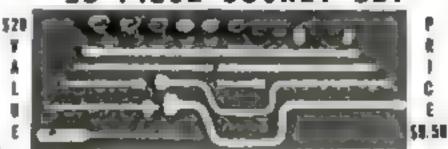
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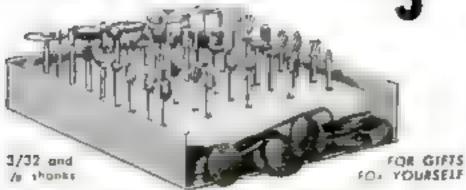
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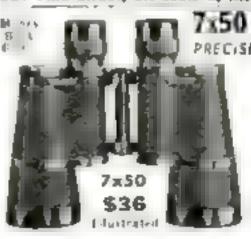


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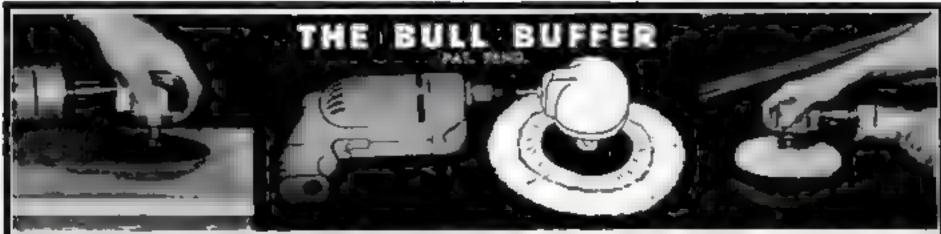


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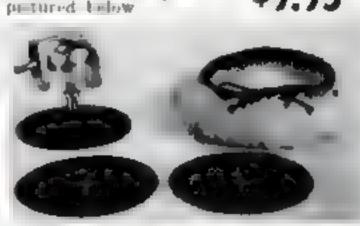


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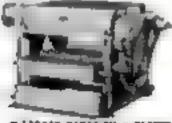
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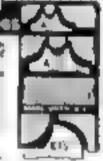
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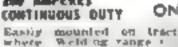


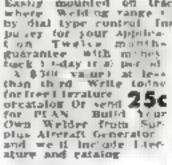
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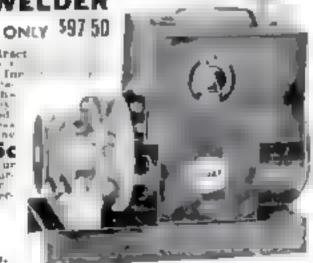
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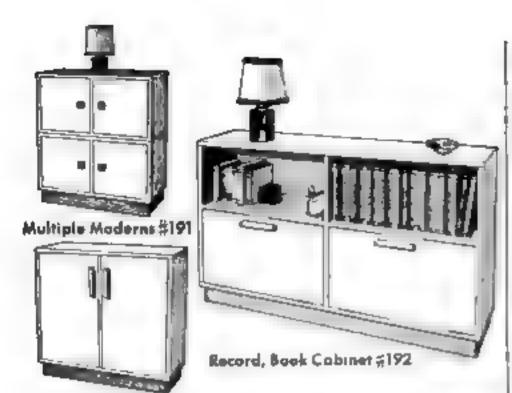
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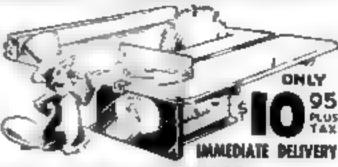
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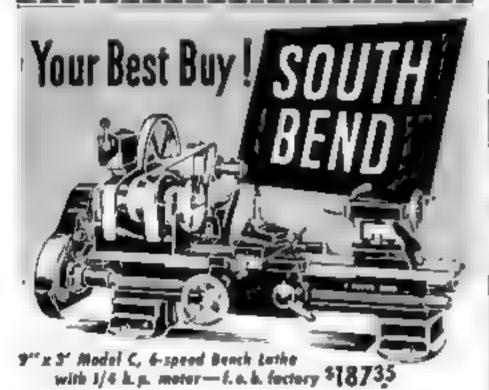
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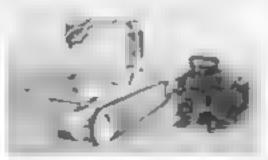
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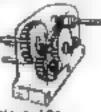
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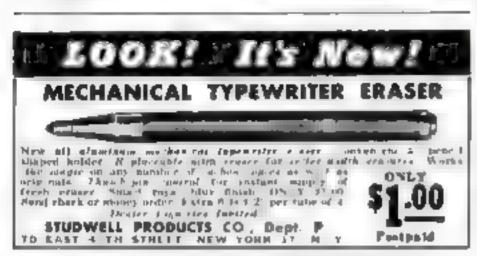
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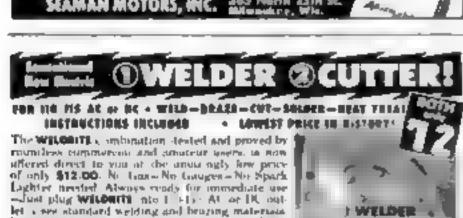
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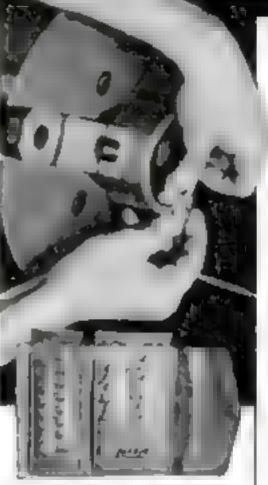
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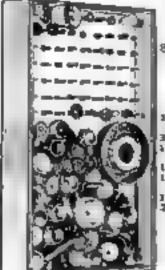
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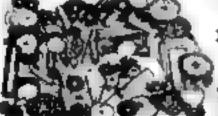
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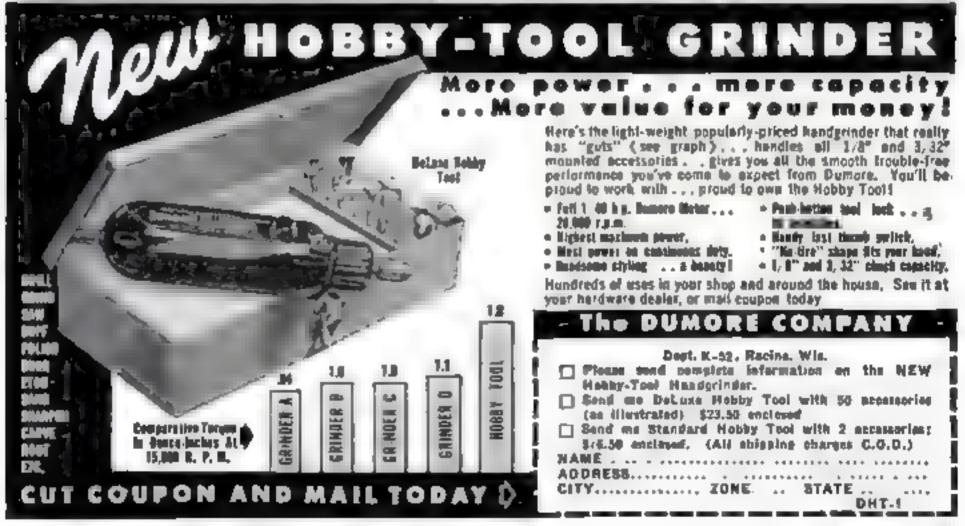
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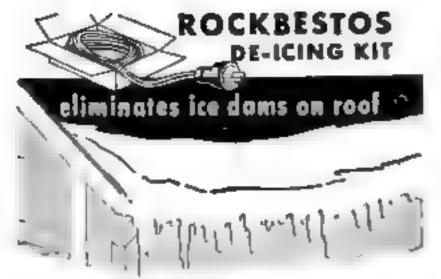
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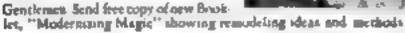




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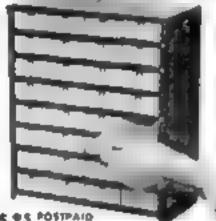
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2-CYLINDER PISTON TYPE

Operates with 1/2 H.P. Motor or equivalent gas engine.

Complete outfit consisting of compresses, pressure tank, air gauge, air chuck, 20-ft. hese, oop valve, copper tubing with 6 brase flared fittings for connecting compressor to tank, 4-way cross and 3 simples. Complete outfit of 7 items

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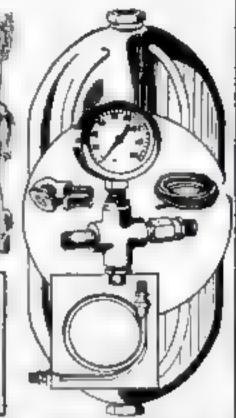
#### THE COMPRESSOR

Model T-1 Brand

Proton Type 2 cylinder 2 hill bore 112 Stroke Bat Bearing 3 27 L F til at 6 0 P M C the 5 ab to 6 54 C F M is reported operating pressure 75 P 8 1 PIMESSIES operating pressure 75 P 8 1 PIMESSIES with wide 112 high high new deep Mr 10 ha

TANK and ACCESSORIES

O' a 34 statement steel are suitable for 130 lb pressure Two 12 space. At fault paper are are thuck 2' it have Copper tuling and 0 he as them W 15 1 a

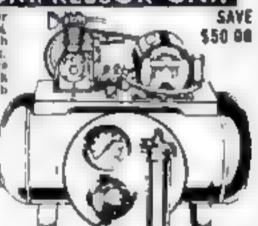


#### AUTOMATIC COMPRESSOR

1 3 H P heary du 5 superitor motor At 110 - 0 roll 60 evice 2 & 1% ties 6 stor table compressor aplach Fig. 190 lest in 12 x 24 anch tank. range 100 to 1.5 lbs ( FM 2.2, check a se safety table are rigo ator with ga ge and filter 20 ft are hose with are chieft for in that my tires V in theirs

Ber beindig mit on son Special \$79.50

Rame unit as above with 13° s.24° tone, mother furnished with 13° s.24° tack, CFM 2 8 at 528 lb, pressure thips no



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External Atomizing

Fint and found spray, quart cup Requires 2 c.f.m. at 35 to 40 lbs pressure, Ideal for spraying lacquer, syn thetic enamel lend paint etc

Sproy gun with 20 ft hase and Hittings, Wt. 7 lbs.

Spray gun only, wt 5 lbs

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Complete with netructions on \$89.90 Harperen disease How to West Sale price fit pd 307.70 Same unit with halmal, rads, halder, cables, atc fvs. gd 5104 50.

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Finest steel and beings do se fea a M in I power cathe serial fit is more cachers merchant factor as a linear type of the house of the wish of car disc serior more power take of far particular type etc Instructions

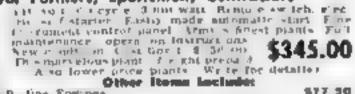
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(Formerly LECO ENGINEERING COMPANT)





NEW! Trash Disposal Unit Burns Refuse Safely

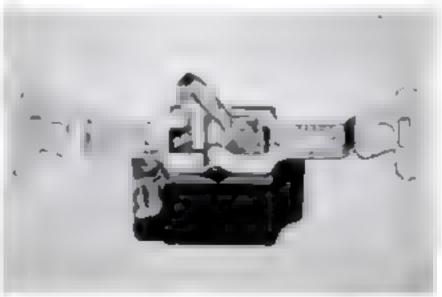
A new type outdoor dispose-all unit safely and quick y burns garbage and trash in any weather All refuse damp, green or dry is fully consumed Scientific draft design completely eliminates are hazard of flying ash, sparks burning blowing bits of paper intense combustion removes he ghoor annoying aulsance of flying scraot amoke size!

Sturdily bu . to last for years Nothing to get out of order Needs no watching Will not blow over Will not destroy grass or shrubs Ends refuse hauling and fire heards to quickly pay for itself bleasures 23° square at base by 40° high Weighs 19 ibs Over 2 bu, especity Recommended by Buranus of Fire Prevention Full price 38 95—nothing else to buy Sent FOB Cleveland Money back guarantee Send check rash or money order to

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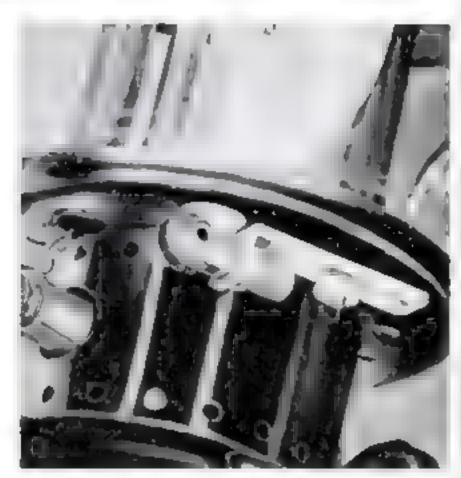


Multiple-Action Rolling Pin. Instead of one roller, this Bakelite® rolling pin has eight small ones. The maker, the Magnus Harmonica Corp., Newark, N. J., says that since the small rollers run over the dough oftener than one large one, the dough can be rolled thinner more quickly. A frame 7 inches in diameter holds the % inch rollers. The price is about \$1.70.



Switch Has Neon Lamp. Within the housing of this wall switch is a tiny neon lamp that directs light to the transparent-plastic switch handle. It glows only in the off position as a guide in the dark, and uses only about 10 cents' worth of current a year. It's priced at about \$1 by Sears, Roebuck and Co.

# Modern Living



Lighter Bolts to Lantern. Working like a cigarette lighter, this gadget lights a gasoline lantern at the spin of a wheel. Tim's E-Z Lite<sup>®</sup> is made to fit all makes of gasoline lanterns, according to the distributor, Timeor, Inc., of Cleveland, O. One bolt holds it to the lantern. The lighter also fits gasoline lamps, stoves, and heaters. It's priced at about a dollar.



Pie Pan Has Juice Groove. Instead of dribbling into the oven, juice that overflows a pie goes into the juice groove when one of these tins is used. The pans, made of 24-gauge aluminum, take a standard 9-inch pie. Two pans fit the average oven. They're priced at two for 97 cents from Walter Drake, Colorado Springs, Colo.



Rubberset's amazing new self-feeding FLO-MATIC Pressure Roller lets you point smooth as a professional painter!

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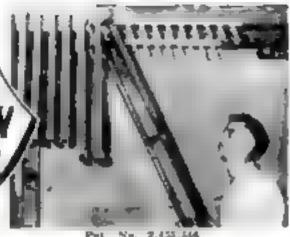
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Will hang windows vertically or horizontally. Installa tion instructions accompany each order.

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13	window	eet.	1.4	brockets)	\$3.49	plys	lác	maching
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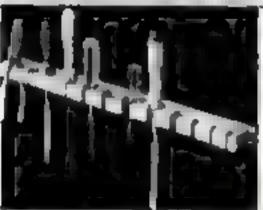
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# Aids to Hodern Living



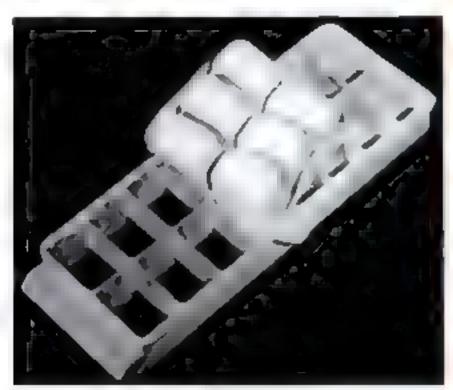
Converts Bottle to Lamp. Making a lamp of almost any vase or bottle is simple with these adapters offered by W. N. de Sherbinin, of Brookfield, Conn. The cork section comes in three sizes-1%, 1%, and 2% inches. It's a circular cork strip that can be peeled down, if necessary, to conform to the bottle neck.



Faucet to Fountain. The Handy Ann Faucet<sup>®</sup> attaches to a faucet by a rubber coupling. Push the lever up and it's a fountain. When you shut off the water, the lever drops and it is a faucet. It's especially handy for children. Handy Ann Products, Minneapolis, prices the nickel-plated, rustproof gadget at \$2. It has a built-in screen that prevents splashing.



Lifts Tonsted Minima. Toast Lifter, distributed by Benjamin & Medwin Inc., New York City, is a stainless-steel cage that fits almost all two-slice, pop-up toasters. English muffins and other breads that won't reach the top of the toaster slots can easily be removed with Toast Lifter. The price is about \$2.



Remove One Cube at a Time. A flexible latex liner in the Cube Drawer® makes it easy to remove only the number of ice cubes you need. According to the maker, Cube Drawer Corp., Akron, O., a single cube may be removed just by pushing up on the underside of its pocket. The drawer retails at about \$2 and extra liners may be purchased separately if needed.



# Last minute news & notes...

THE MOSQUITO that zings
you next year might make
a little click in a
Geiger counter. But
don't let it worry you or
waste your batteries.
Army doctors are now
rearing the little hummers in "hot" water in
the hope that radioactive
skeeters will signal how
the pests migrate.

MORE LIGHT is coming in smaller packages. The 150-watt bulbs now being manufactured by Westing-house are an inch shorter and a quarter-inch slimmer than the old bright-light jobs. Easier to get into that fixture over the bathroom mirror.

NOW THEY TELL US that garbage cans don't have to stink. Monsanto chemists have cooked up something to halt the molds and bacteria which decompose the garbage to produce the stench you don't love to uncover. Just ask for "Orthobenzylparachlorophenol."

NUMBERS instead of colors are being used to code wires for complicated electrical controls. The numerals are branded on every inch of insulation and won't wash or wear off. The makers (Midwest Automatic Control Co., Des Moines) unimaginative-

ly call it "Magic Wire".
Harassed electricians,
contorting themselves
through today's elaborate
circuits, think "Number
Please" might be more
appropriate.

DISHWASHERS that call for less work on the part of the housewife than washing the dishes herself are every husband's dream. A new principle, developed by Husband Jerry LaRaus of Westport, Conn., uses jets that do the job on both sides of the plates.

SCIENTISTS are excited over the latest news from Berkeley, Calif., that a quarter-scale model of the proposed 5 to 7 BILLION wolt "bevatron" is now running sweetly. Tests show that plans for the biggest atomic accelerator ever designed are basically okay. The bigbillion job ought to be ready in three or four years.

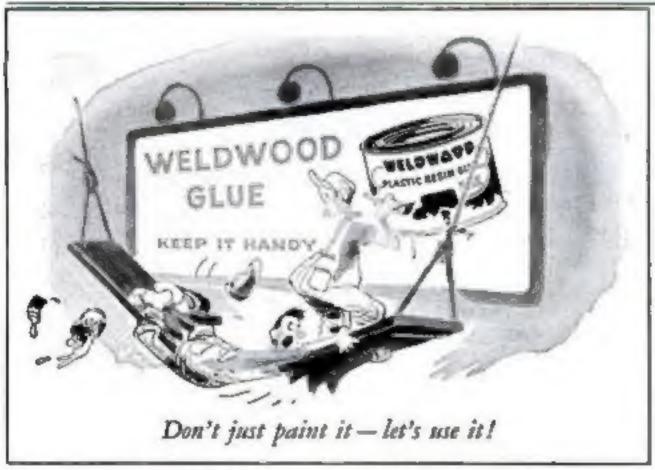
GAR WOOD's new boat is not idly named "Venturi."

It's a seagoing windtunnel that steadies itself by squeezing the air that rushes through the square gullet formed by its split hull and curved underdeck.

The Editors

This One Heez-WJF-TB08







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